Products finishing

FRED W. VOGEL, Editor

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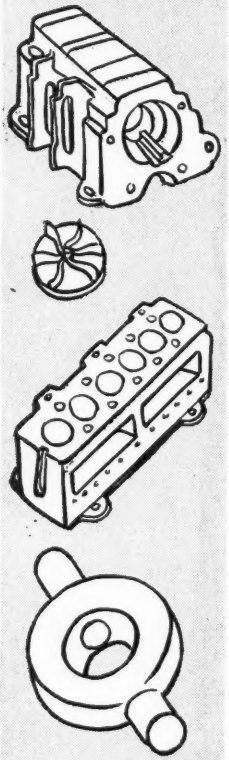

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Products Finishing

MANY defense production industries are being affected by shortages of the commodities necessary to the manufacture of armament and unless measures are adopted for conserving these materials, the problem may become serious. At the present time, the Army and Navy Munitions Board Commodities Division has divided these materials into three classifications as follows:

Strategic Materials. Strategic materials are those materials essential to the national defense for the supply of which in war dependence must be placed in whole, or in part, on sources outside the continental limits of the United States, and for which strict conservation and distribution control measures will be necessary.

Aluminum, antimony, chromium, manganese, nickel, and tin are considered strategic materials.

Critical Materials. Critical materials are those materials essential to the national defense, the procurement problems of whch in war, while difficult, are less serious than those of strategic materials because they can be either domestically produced or obtained in more adequate quantities or have a lesser degree of essentiality, and for which some degree of conservation and distribution control will be necessary.

Cadmium, platinum, and vanadium are considered critical materials.

Materials neither Strategic nor Critical. In this classification are included those materials, essential to the national defense, for which no procurement problems are anticipated, but whose status is such as to require constant surveillance because future developments may necessitate reclassification as strategic or critical.

Abrasives, copper, iron and steel, lead, magnesium, molybdenum, sulfuric acid, and zinc are considered neither strategic nor critical materials.

The very least anyone can do at this time is to conserve those materials which are vital to our defense industries.

Finishing is Important Part of Norfolk and Western Maintenance Program

By CARLETON CLEVELAND

THE paint department of the Norfolk and Western Railway is an all-important part of that company's general shops at Roanoke, Virginia, since it has the gigantic task of keeping, not only rolling stock, but other company equipment, protected against deterioration and in pleasing appearance by the application of paints and other protective coatings. This task involves not only the original painting and the repainting of over 57,000 units of passenger and freight equipment, but an endless stream of miscellaneous road equipment such as motors, tractors, tenders, signs, banners, dining car furnishings, desks and office equipment, even houses and office buildings, interior decorating—in fact, everything that requires repainting or refinishing.

The shops at Portsmouth, Ohio, Bluefield, West Virginia, Lambert Point, Virginia and other places along the line do considerable painting in connection with repair work, but the distribution and general supervision of painting for the entire system is handled from the paint department at the Roanoke shops.

Here more than 46,000 units of the rolling stock to be painted con-

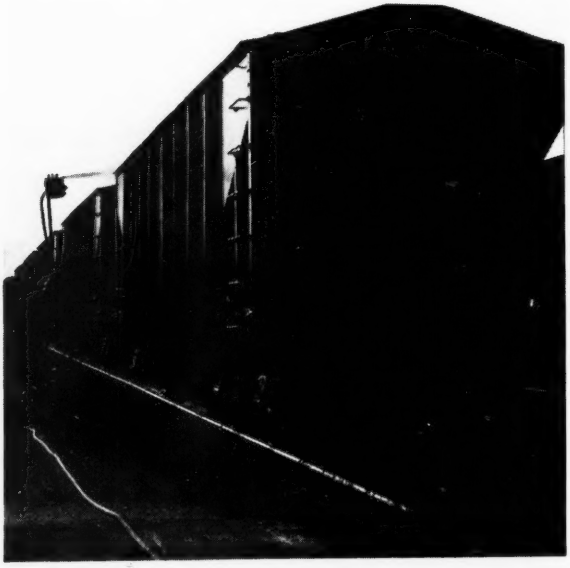

Fig. 1—Spraying Black Paint on Rebuilt Norfolk & Western Hopper Bottom Coal Car in the New Paint Yard at the Roanoke, Virginia, Shops.

Fig. 2—When Lettering is done, the Stencils are Hooked over the Top of the Car so that they are in Correct Position without Time-wasting Adjustment by the Spray Operators.

sists of coal cars—hopper bottom and gondola types—which carry the larger part of the great volume of Norfolk and Western traffic. Since the N. & W. annually transports some 40,000,000 tons of bituminous coal, or "Fuel Satisfaction," to use the company's term, it will be seen that the cars handling this load must take a terriffic beating. They must necessarily be sturdy and strong, while the paint coating preserving the metal surfaces must meet exacting specifications so that the cars may be kept in good condition and present a favorable appearance as they roll along, laden or empty, in the glorious sunlight of a balmy summer day or through the chilling bleakness of a mid-winter blizzard.

During 1940 the crew at the Roanoke shops handled the painting of approximately 5,759 rebuilt coal cars —an average of about 20 cars a day and 14 on Saturdays—using some 27 gallons of paint per car, or an astounding total of 155,493 gallons of paint for coal cars only. These were all rebuilt cars; had they been merely repaired cars the total might well have been doubled, for the number of cars handled would have been very much larger. The paint shop uses about 140 different kinds of paint, six cleaners, six varnishes, and two shellacs in the various departments of its work.

Painting Coal Cars

Since so much of the activity at this shop centers around the painting and repainting of coal carrying equipment, it might be well to observe the

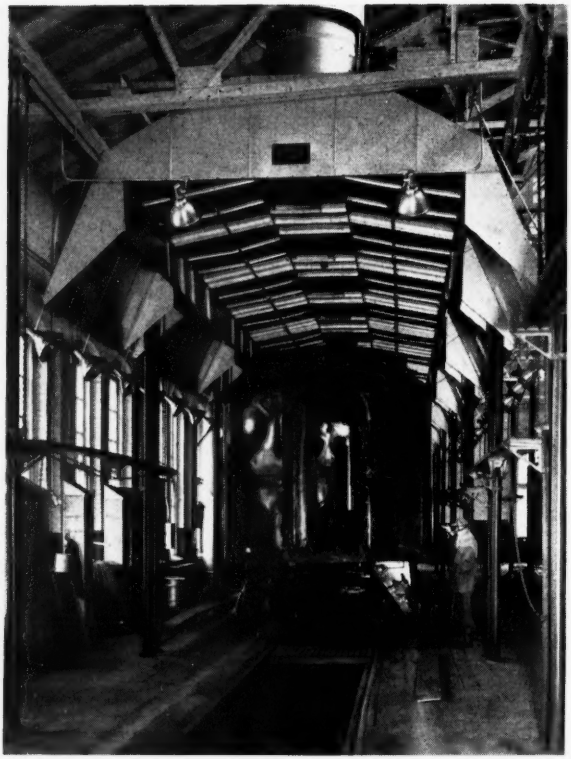

Fig. 3—View in Main Paint Building Showing Circulatory Ventilation System and also steam heat pit running beneath Cars.

process and methods that have been found satisfactory by those responsible for this work. As a new or rebuilt car comes off the assembly line after final riveting, it glides down from the "hump" to a station where it is thoroughly cleaned with mineral spirits. The car is then moved into a canopied shed where it receives a prime coat of lead and zinc chromates, a reddish brown base paint, applied with a siphon spray. The car is then shunted on down the track to a recently constructed paint yard, where it receives two sprayed coats of carbon black. The lettering on coal cars is stenciled through huge zinc stencil sheets fitted to hook over the edge of the car and hang down the side in a perfectly true position while the operator sprays white paint through the stencil.

The inside of the car is given a heavy coat of "car cement" directly over the priming paint coat. The car cement is a mixture of asbestos fiber and asphalt, which forms an extremely tough coating, its purpose being to protect the inside of the car from grinding and abrasive action of the coal. This coating, therefore, becomes a very important element in the life of the car.

The bed frames or sills in the coal cars are virtually indestructible—corrosion being the only thing that can wear out these sturdy coal carriers. For that reason, a thorough painting job is important; about 27 gallons of paint being required for the complete painting of an N. & W. coal car. It has been found that a thorough painting of this type of equipment will keep it in serviceable condition for from three to four years when in general daily use.

Re-finishing Passenger Coaches

New passenger coaches are sandblasted before receiving their first

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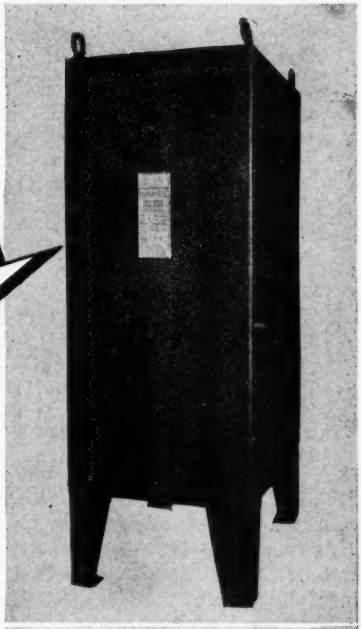

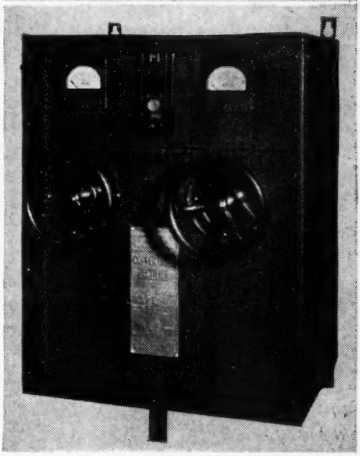

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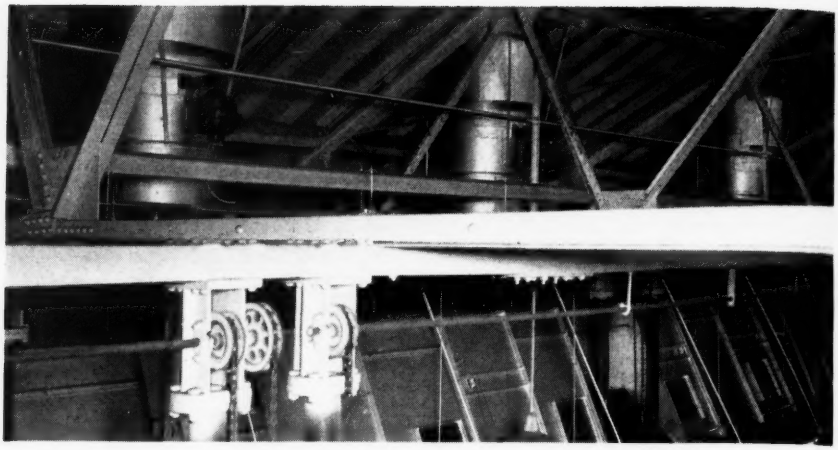

Fig. 4—Up above the Canopy Showing Motors that Drive 42-in. Suction Fans Inside each Stack.

painting, the average sand-blasting lasts from 12 to 14 years. All Norfolk and Western coaches, however, are carefully washed and re-painted every three years. As the cars come in off the road for "rejuvenation" they are first washed and scrubbed with a jelly-like soap and plenty of water. After a thorough rinsing, all indentations and scarred places are touched up with primer and leveled up with putty and glazing. The entire car is then sand-papered to a smooth, level surface.

Windows and other glass areas are either covered or given a coating of non-drying dope. If the gold lettering is still in good condition, the dope is applied to the lettering. After this, the car is sprayed with two coats of enamel. When the enamel has dried, two coats of varnish are applied. All passenger cars are painted a Tuscan Red, a deep dark red, the paint being a composition made from synthetic gums—a synthetic paint, and varnish. Lettering is penciled on gold leaf, which has proven very durable, far outlasting the car paint.

All parts, both inside and outside of passenger coaches are painted and refinishing at the same time. Many metal parts such as hardware and fixtures are replated and burnished and given a coating of clear lacquer which is baked on. While it is a large undertaking, the paint department is able, if necessary, to handle one complete passenger car a day.

Locomotive and Tenders

Locomtives and especially the tenders are treated in much the same manner as passenger cars. They receive first a priming coat, then surfacing coats after which they are rubbed with a pneumatic rubbing machine which smooths off any rough spots and levels the surface. The finishing coats are then applied and present a beautiful attractive hard finish which is easy to clean from time to time.

Box Cars and Cabooses

Box cars are painted oxide brown, a semi-synthetic paint that will last

an average of three to four years. Lettering is done by use of zinc stencil sheets. Cabooses are painted "Devil's Red," the lettering being stenciled on in white. The inside of the caboose or "cabin cars" are finished in a light easy-on-the-eyes green.

The paint department at the N. & W. Roanoke Shops centers around a group of six main buildings, all connected by tracks and driveways, and strategically located so as to save time and expense in moving stock to points of operation. The main building is a huge structure fully equipped with automatically adjustable, counter-balance type scaffolding, flexible enough to suit every need of modern car painting. Cars are run into the building on tracks over long pits equipped with steam-heating pipes.

Floor vents on each side of track admit a constant stream of fresh air, while over the car is a long canopy through which fumes are exhausted to outside stacks. A 42-in. motor driven suction fan in each stack draws fumes and excess spray upward, forcing clean, fresh air up through the floor vents, keeping an upward moving stream of air surrounding the car. The spray operator must reach through this moving air current in order to paint the car. In other words, there is a continual curtain of air constantly moving between the operator and his work. In all the paint buildings, even the temporary ones, adequate ventilation is supplied through top and bottom vents in the walls. This main building, which also houses the operating offices of the paint department, is thoroughly protected by a sprinkler system.

Fire protection, of course, is an important factor in the paint department, and the N. & W. paint shop has a remarkable record, with no fires in several decades. A Fire Inspection Committee, composed of shop foremen, inspects the shops every Saturday and turns in a detailed report recommending changes in any conditions considered as potential fire hazards. The work of this committee, combined with the modern sprinkler system, and the constant vigilance on the part of every employee, has kept a high safety record in the Roanoke Shops. It is interesting, too, that, as

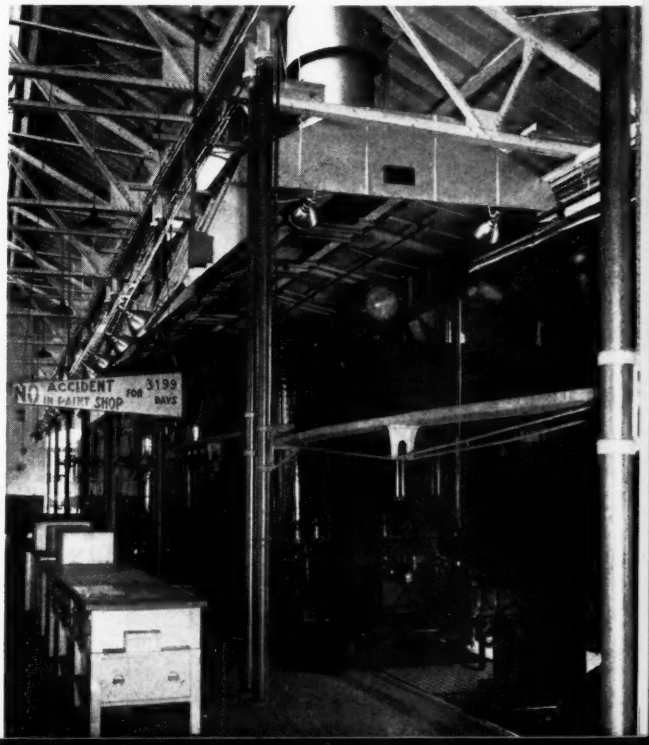

Fig. 5—Another View of the Canopy Equipment.

WHAT'S YOUR W

E. I. DU PONT DE NEMOURS & COMPANY (INC

UR WORRY, MR. MURRAY?

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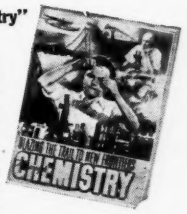
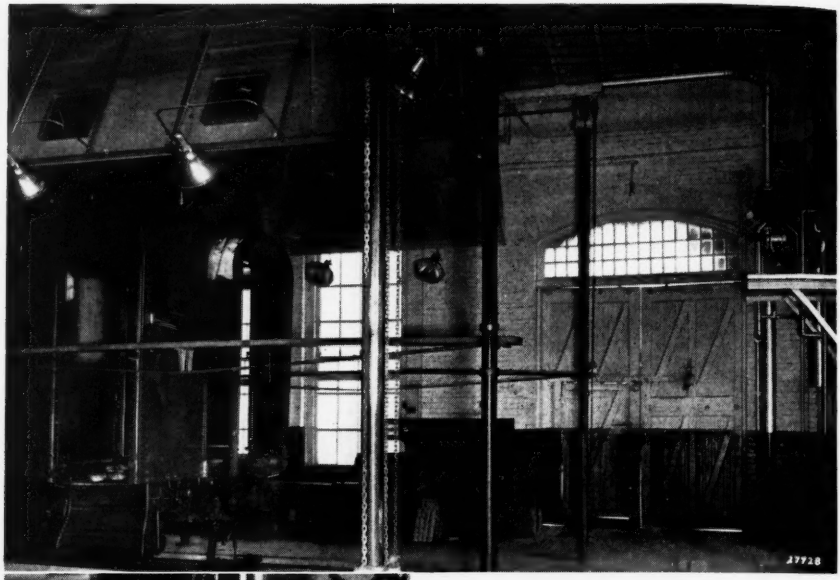


(INC) FINISHES DIVISION, WILMINGTON, DELAWARE DU PONT REG. U.S. PAT. OFF.



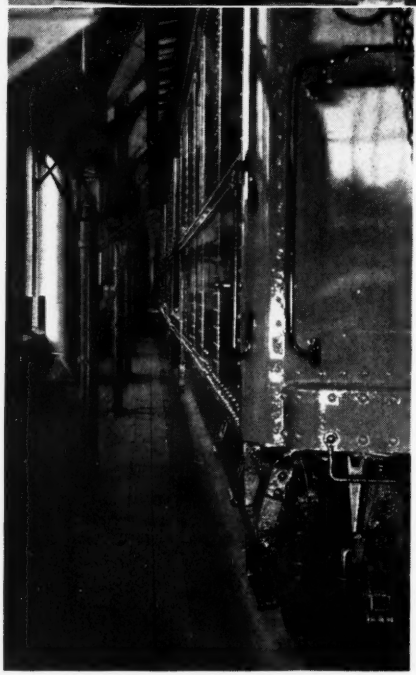


Fig. 6—(Above) One End of Automatic Adjustable Scaffolding. Balance Weights Inside the Metal Posts simplify Adjustment. Mounted on Platform at Right is the Automatic Sprinkler Control Machine with Siren and Horn for Warnings. Fig. 7—(Left) Vents in the Floor Beside the Tracks Provide a Constant current of Air or Air-Curtain to flow Upward, Surrounding the Car being Painted. As Air and Excess Spray are Drawn off through the Canopy, Fresh Air Flows through the Floor Vents.

•

of December 16, 1940, these men have not had an accident or a reportable injury in the paint department in 3,332 days.

Among the group of the paint shop buildings there is a sand-blasting house for passenger cars and locomotive tenders and detail work, fully equipped with the necessary compressed air facilities, a washing building where the passenger cars and locomotive tenders to be repainted are first shunted for a thorough washing and scrubbing inside and out. Each car is given a complete

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rinsing after scrubbing with a jelly type soap.

There is also an elevated storage building with a concrete unloading platform and other facilities for the efficient handling of materials shipped to the paint yard, as well as to nearby departments. Here are stored large stocks of paints and painting mixing materials. Paint that comes into the shop in tank cars is piped into huge vats in the basement of the storehouse building. There are thirteen of these tanks at present, twelve of 1,900-gal. capacity and one of 2,000-gal. capacity, used for storing oils, solvents, and other paint materials.

Fig. 8—Stacks of Ventilating System Outside Main Paint Building.

From these storage vats the paint is drawn off into any one of four 200-gal. capacity mixers. These mixers discharge into pipe lines leading outside the building, where the paint materials are run into 200-gal. tanks that are taken by motor cars to various points of operation throughout the paint department buildings and the paint yard. The office of the paint stock house foreman is also located in this building.

Just behind the yard assembly line there is a group of temporary sheds used for applying the priming to coal cars. There is also a laboratory where research and testings for paint is carried on continually. Every paint material is tested and proven before it is allowed to be used extensively on N. & W. work Painted test panels are given a 45-deg. angle southern exposure, speeding up the weathering action on the paint, and providing a much quicker way of testing certain paints that may be required to last several years on cars in ordinary road service. These tests are, of course, supplemented by other investigations carried on in the laboratory.

The Paint Yard

Connected with the Roanoke Shop enclosure by rail and modern paved driveways is the recently completed paint yard. Formerly it was necessary to paint cars in a congested part of the shop enclosure, which caused extra handling and considerable delay. In wet weather, when painting activities were temporarily halted, the production of cars on the assembly line was slowed down because of insufficient space to shunt unpainted cars. The completion of the new yard, covering some 17 acres, with seven tracks, each 1,200 feet long, accommodates approximately 225 cars. This provides sufficient storage space for at least a week's production from the assembly line, thus former handicaps to continuous and uninterrupted production have been removed.

All painting and stenciling in the

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You'll Get Longer Wheel Life By Using the AD-LEA-SIVE Method In Your Polishing Operations

This Lea Product is featured by:

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yard is done with compressed air. One large building is located on the paint yard. The office of the paint yard foreman is located in this building and a section is devoted to wash and locker rooms for paint yard workers. A portion of the building is used for storage of "car cement" and other paint supplies. Nearby is a power house in which is located a low pressure boiler which provides an ample supply of hot water. Air compressors which furnish compressed air for the paint yard are also located in this building.

Pipe lines with numerous outlets stretch along each of the seven tracks so that connections are available in order that painting operations can go along on each track simultaneously. The rail siding and paved driveway connecting the paint yard with the shops enclosure runs along the north boundary of the yard to the storage building and then south to the middle of the yard, where it joins another driveway running east and west between the tracks. Since this driveway is never blocked, it provides a ready access in case of fire. It is also useful for the delivery of materials by the shop motor trucks or by tractors and trailers. The new yard is modern and serviceable in every way, and it will make possible greater efficiency in the painting of the thousands of rebuilt coal cars being turned out at Roanoke Shops. With a daily average of 20 units coming off the assembly line, and the daily output of the paint yard estimated at an average of 30 cars, the painting crews should be able to keep well up with production.

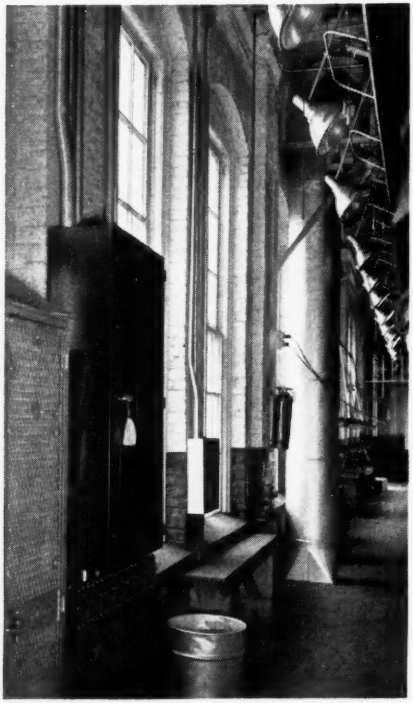

Fig. 9—Aisle Along Track Just beneath Canopy, Showing Control Board from which the Circulatory Ventilation System is Regulated and Controlled.

No matter where one meets them, at one end of the country or the other, the rolling stock of the N. & W. is always in good shape and attractive in appearance. Painting being considered a vital element in the operation of rail cars, particularly in the interests of preservation and in reducing maintenance costs to a minimum, only the best materials are used and applied with modern equipment by the most experienced men.

Wagner Fan Catalog. The 1941 Wagner fan catalog, now being issued by Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., illustrates and fully describes the complete line of Wagner cooling and ventilating equipment for 1941. This 20-page catalog also contains installation and application data, making it especially helpful to dealers and contractors using it as a sales manual.

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Modern Gold Plating

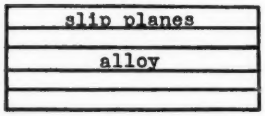
By JOSEPH B. KUSHNER, CH.E.
Metal Finishing Consultant
New York City

IN our discussion of the Bek Process last month we saw how diffusion of the base metal into the gold deposit tended to increase the hardness of the gold alloy. Now we are going to consider a new and valuable adjunct to the process which provides a means for obtaining extremely hard gold plating. This method of producing hard gold deposits was mentioned previously in Part 5 of this series, and is known as age hardening.

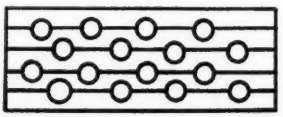
Toward the close of the first World War a number of metallurgists were experimenting with aluminum and its alloys, trying to find lighter, stronger metals for building aircraft. Among the alloys was one mainly of aluminum, copper and magnesium, known as duralumin. It had peculiar heat treating properties. If it was heated to almost the melting temperature and suddenly quenched, then left at room temperature, or reheated at a low temperature, a strange phenomenon took place. The duralumin became extraordinarily hard.

In 1919, one of the metallurgists engaged with this problem, Paul D. Merica, then working for the U. S. Government, published with some of his colleagues, a paper on duralumin's odd metallurgical property. In his paper, Merica propounded a rational theory for what he called "Age Hardening." With that paper a new world in metallurgy was opened up—a world in which the gold plater is going to have increasingly greater interest as time goes on. The phenomenon, which he termed age hardening and which has come to be known alternately as precipitation hardening, is one of great complexity and some points of its theory are still subject for discussion.

For our purposes, it is enough to say that certain metals or metallic com-



Atoms of poorly soluble metal in homogeneous solid solution.



Atoms of poorly soluble phase precipitate along slip planes, on aging.

Fig. 25—Drawing illustrating the phenomena of metal atom precipitation.

The author discusses age hardening of gold deposits and gold plating by the barrel method.

Part 7

pounds of limited solubility in other metals at normal temperatures, are completely soluble at high temperatures, and form homogeneous solid solutions. If an alloy of these metals is quenched from the high temperature we get what is tantamount to a supersaturated solution of the poorly soluble metal or compound. This is an unstable condition and must be equalized gradually at room temperature and much more rapidly at slightly elevated temperatures so that the metal or metallic compound of limited solubility starts precipitating out of the solid solution.

The precipitating atoms of metal crystallize in finely divided form and grow as the process of "aging" continues. But instead of crystallizing at random throughout the alloy, they seem to be rather choosy and pick only certain places in the lattice structure for precipitating. The favorite spots are along what metallurgists call slip planes as illustrated in Fig. 25. Here they act as "keys," locking the slip planes and stiffening the metal. Just like a deck of cards, the slip planes in a metal slide along on one another. If we put little pins on the surface of every card, they don't push around so easily, and the deck as a whole, becomes harder to manipulate, just as the metal becomes harder. Perhaps this is not the best analogy but it will do.

After the discovery of the age hardening property of aluminum alloys, other combinations of metals were sought for that had this valuable property and the metallurgists soon found them. Indeed, it was dis-

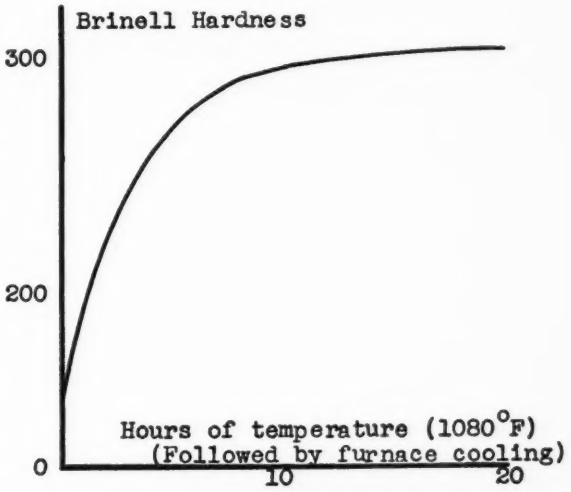


Fig. 26 — Graphical illustration of the age hardening properties of K Monel.

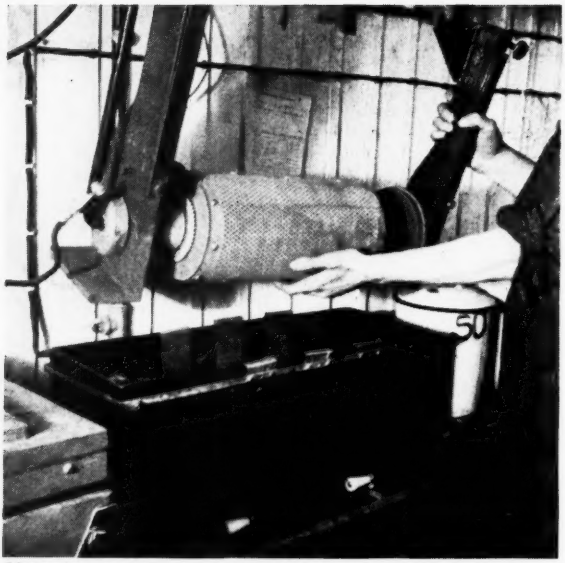


Photo Courtesy the Durocharm Co.

Fig. 27—This small horizontal cylindrical barrel is designed for gold plating.

covered that a great number of alloys had this characteristic but only a few possessed it in marked degree.

Russian and German scientists experimenting with gold and its alloys, soon found that combinations of gold and platinum, gold and palladium, gold and nickel and a number of other binary, ternary and quaternary alloys of gold were capable of being age hardened. The Germans took almost immediate advantage of the discovery by making use of these alloys for dental purposes, where high corrosion resistance plus great strength are prerequisites. Matter of fact, the Germans, with their penchant for "erzats" have reached the point where their age hardenable gold alloys for dental purposes, contain no gold. The American dental people took up these discoveries as well, and in recent years have developed age hardening to such a point that they are able to produce golds that are literally stronger than steel.

The question now arises, "how can we use age hardening in gold plating?"

Here is the answer. Plate on one of these age hardenable gold alloys, and then heat treat. Unfortunately, it is not as easy as all that. The first heat treatment to produce a homogeneous state is, with few exceptions, generally at such a high temperature as to preclude its use on most classes of work. However, there is another possibility open which can be taken advantage of only by such a process as the Bek Process and that is this: Beryllium copper and certain alloys of nickel such as K Monel and Z Nickel are amenable to age hardening treatment. A typical example is K Monel, an alloy consisting principally of copper, nickel and aluminum. A cold drawn rod of this metal before hardening may have a Brinell Number of 150; after age hardening the number goes up to 300. Figure 26 shows something of this property. In actual practice, Z Nickel, an almost pure nickel (98 per cent) with a little aluminum added, turns out best for gold plating work inasmuch as it requires only a heat treatment of from 6 to 9 hours at 900 deg. F. to produce a good hardening effect. Well then, the idea is this. Make your objects to be gold plated out of Z Nickel, which incidentally is a highly corrosion resistant metal and

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can be formed; plate a gold alloy deposit on it, and heat treat for 6 to 9 hours at 900 deg. F. While the gold and nickel are diffusing (see photomicrographs in Part 6 of this series) the nickel is also age hardening. The ultimate result is a really hard gold plate. As pointed out in Part 6 an age hardened deposit of this type offers maximum wear resistance.

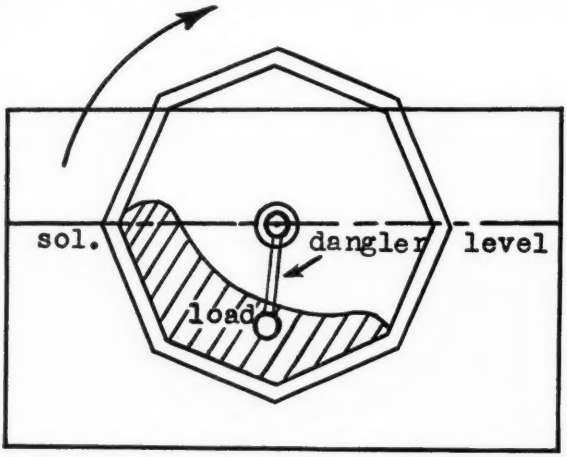

Fig. 28—A cross section diagram view of a fully loaded gold plating barrel.

Of course, it is not beyond the range of possibility to deposit a special alloy of gold, and other metals, so hard in itself that it does not require heat treatment or age hardening. In fact, when we learn to deposit really bright plates of gold* as we deposit bright plates of nickel, the chances are the bright gold will be hard enough to enable us to eliminate the hardening procedure, whether it be diffusion alloying, are hardening or a combination of both.

For the moment we are going to end our discussion of alloy gold plating and hardening to take up some general aspects of gold barrel plating, since we have received a number of requests for a paper on this subject.

* To be discussed in a future article.

GOLD PLATING IN BARRELS

There was a time just a few years ago when if you mentioned plating gold in a barrel you would have been considered slightly on the balmy side. The idea of plating small objects with gold in a barrel just as other small objects were plated with nickel, copper or zinc was practically unheard of. There seemed to be too many natural drawbacks to doing such a thing. Though most of these drawbacks have been removed by modern barrel designing and methods, they still persist in the minds of manufacturers who could be profitably employing gold barrel plating this very minute.

What are those so-called drawbacks? The first thought that enters the manufacturer's mind when you mention barrel gold plating is cost. "A barrel. That involves gallons of solution and strong solution too. My girls can rack up thousands of pieces a day and my plater can plate them in a five gallon pot. Why bother with a barrel? And the barrel itself, costs plenty too."

The second thought is about uniformity of results. "I've seen some of those barrel plated parts. Everyone is a different color! Anyway some of the parts get a lot of gold and some get none at all. That's waste."

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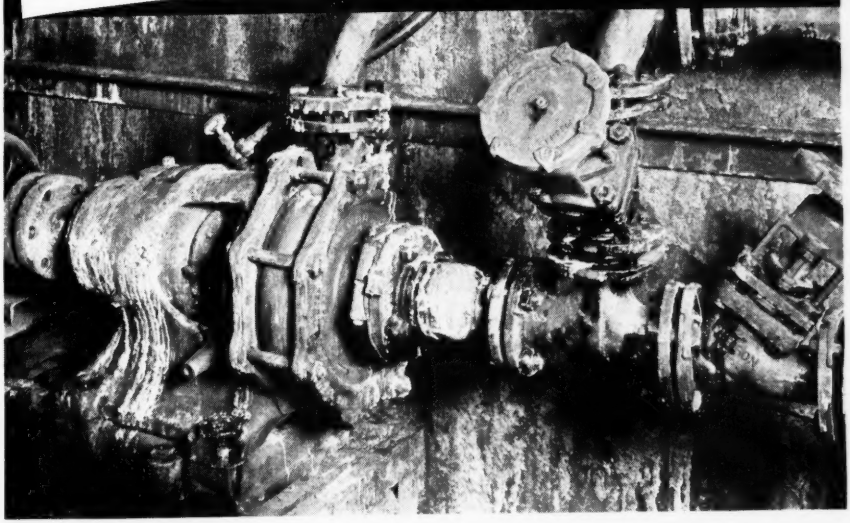

This Duriron pump is taking nickel plating solution over the top of the plating tank and filtering through a plate and frame press. It is used also to transfer plating solution to and from storage tanks located outside the building.
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The third thought is about drag-out. "The drag-out from such a barrel must be terrific! It would cost us a fortune on drag-out alone. And how much gold is wasted on the contacts?"

In the light of present day developments all these bogies have turned out to be thin air. Let us see why.

COST OF GOLD BARREL PLATING

The ordinary plating barrel of the type used for copper, zinc or nickel plating will hold approximately 50 gallons or more of solution. In all these barrel plating operations it is customary and required to run at high metal concentration. If gold is the same in this respect, figuring on a minimum amount of solution, 50 gallons, and a concentration of ½ ounce of gold per gallon, we arrive at the fact that we will have to use 25 ounces of gold in our solution; $875 worth to be exact, which is no hay. Then, if you consider the cost of such a barrel (it generally runs into well over $200), you have the sizeable investment of over a thousand dollars to start with. Initial cost seems to be fairly good argument against the adoption of gold barrel plating.

But first cost is not as great a factor as it would seem and for these reasons: (1) A large barrel is not necessary to get out production on small parts. It must be remembered that in a barrel plating operation with nickel or copper a given load may run for hours because usually fairly heavy deposits are desired and cathodic efficiencies are low. That of copper in a barrel for example ranges around 20-25 per cent and that of nickel is about 30-35 per cent. Under conditions like these you have to put in a large load at a time to get anything out in a working day.

With gold it is another story. Usually, only a very thin, flash coating gold deposit is desired; the cathodic efficiency is considerably better and the electrochemical equivalent is much higher so all that is required in most cases is a run of five to ten minutes to get a nice even color on the work. Since this is the case a much smaller barrel can be used, running in a smaller quantity of solution. The small barrel illustrated in Figure 27 has a capacity of only 2 quarts, yet thousands of dollars worth of work are plated in it daily. With this size barrel we can get out 10 to 20 loads, for example, while a much larger nickel barrel is plating 1 load. Thus, a small barrel of this type, which would be looked upon by a commercial nickel or copper plater as a toy, is capable of handling an entire plant's output. Also, as can be seen, the tank in which the barrel runs is quite small, about 10-12 gallons in capacity.

On the matter of gold metal concentration required, contrary to the common belief, a high metal content is not necessary. A concentration of about .2 of an ounce of gold per gallon is generally quite satisfactory. This being the case, we can figure our initial cost in gold to be 10 x .2 x 35 = $70, more than a ten fold reduction. Since the barrel is smaller, less material is used in its construction and a smaller motor may be used to drive it. This results in a lower first cost on the barrel.

To look at the situation another way, how much will a barrel save during the course of a year? If we take a hypothetical case of a girl racking and unracking 10,000 pieces daily who receives $15 a week for doing it, and eliminate her by using a barrel, we are saving about $780. Thus, the barrel will pay for itself many times over. Other advantages,

such as elimination of operations and reduction of processing time contribute further savings that can be translated into dollars and cents on the black ink side of the ledger. For those manufacturers who are plating many small parts with gold every day, the above bit of figuring should put the first cost bogey to sleep for the duration.

COLOR AND DEPOSIT DISTRIBUTION IN BARREL GOLD PLATING

The writer recalls discussing barrel plating of gold a few years ago with a few hardy pioneers who had the courage to try it. One of them who was doing flash work, complained bitterly about the fact that occasionally he got a batch of mixed colors out of his barrel, running almost every shade of the rainbow and besides it was hard to keep a constant color. The solution had to be thrown out ever so often after a comparatively small number of runs because it invariably became contaminated with copper and zinc from the brass parts he was plating.

Another chap, a chemist for a large button house, aired his troubles, too. He couldn't get a better deposit distribution than 15 per cent on the buttons. He complained most vigorously about the distribution of gold on the buttons; the deposit had to meet certain Government specifications as to weight of gold. The permitted tolerance was 10 per cent. The Government purchasing agents rejected any lot of buttons from which samples taken at random showed less than the acceptable amount of gold. As a result, he had to overplate the buttons to be certain that he had sufficient thickness. They were losing money on

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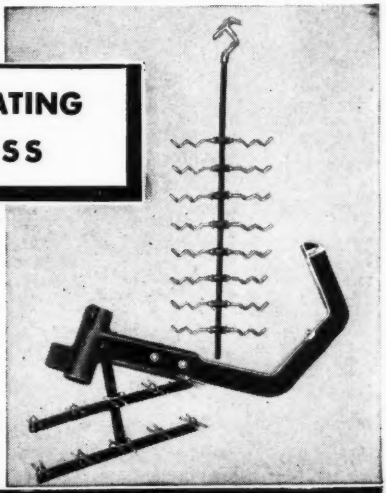

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Development Dept.

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It will probably interest you to know that we use the Wrinkle finish on all our controls. We find that the "eye appeal" even on industrial controls such as we manufacture means a lot to the sales end and this has been helped considerably by the use of Wrinkle Finish.

Very truly yours,
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Doolittle
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Yours very truly,
DOOLITTLE & FALKNOR, INC.

Pipenger
Manager

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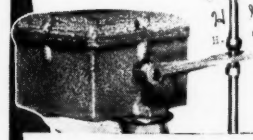
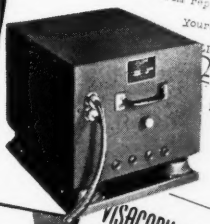
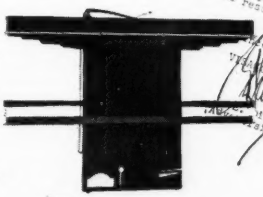
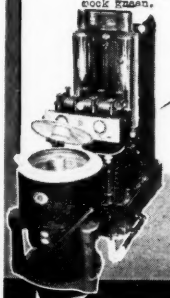
General Manager









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overplated gold at the rate of 5 per cent daily, if not more. The management wasn't happy over the prospect at all.

The problems of both gentlemen stemmed from the same source even though both of them may not have realized it at that time. The trouble was found in improper current distribution.

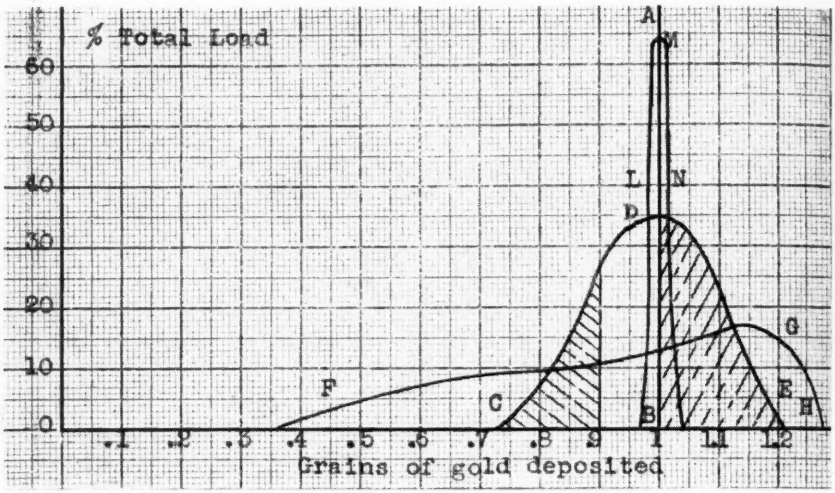

Fig. 29—Graph showing deposit distribution in barrel gold plating (hypothetical cases).

The subject of current distribution in a plating barrel is one that is unbelievably complex from a mathematical standpoint but there are a few general facts that can be unearthed by a little digging.

Forgetting about all questions of polishing and burnishing that may take place during the course of the barrel's rotation and sticking only to current distribution, one fact predominates. In a plating barrel, as in a still tank, the amount of metal that is deposited on a cathode is a function of the current and the time (Faraday's Law $M = K\,I\,t$, where K is a constant, I the current and t the time). If we are plating for a fixed period of time the only variable that has to be considered is the current.

Let us take a cross section of the plating barrel we are going to discuss (horizontal type: octagonal) in action, fully loaded, as shown in Figure 28. As can be seen, the greatest part of the mass is covered by the outer layers of work. Now electricity, like any other force, always likes to do things the easiest way. No matter how you distribute your current, whether from the outside or inside of the barrel you are bound to get most of your current at the outer layers or "skin" of the load. It is true, of course, that if a dangler is making contact with the interior of the load, some of it will be plated since the electrolyte penetrates into every open space and discharges its gold ions inside as well as outside, but a large part of the area that could be plated is not available, for the simple reason

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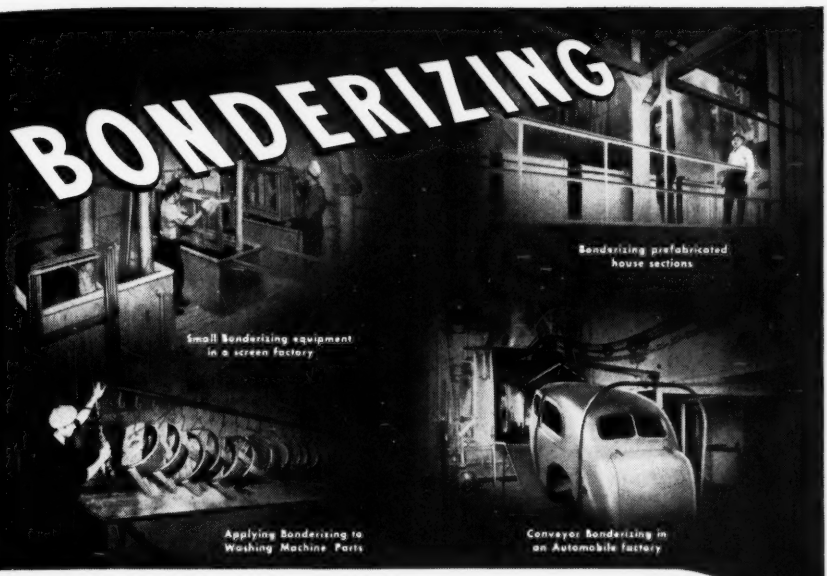

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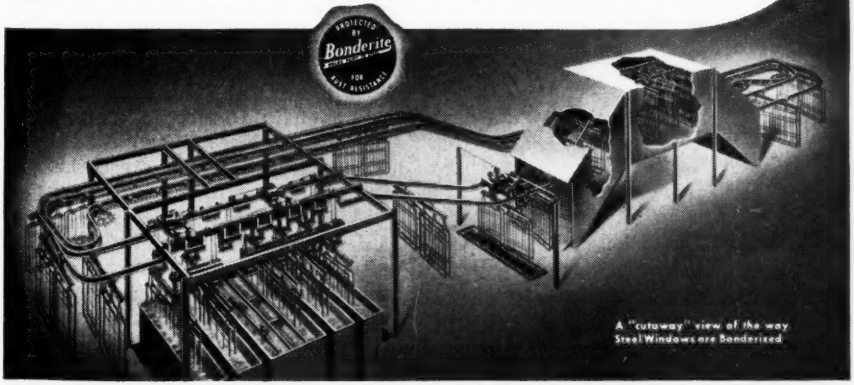

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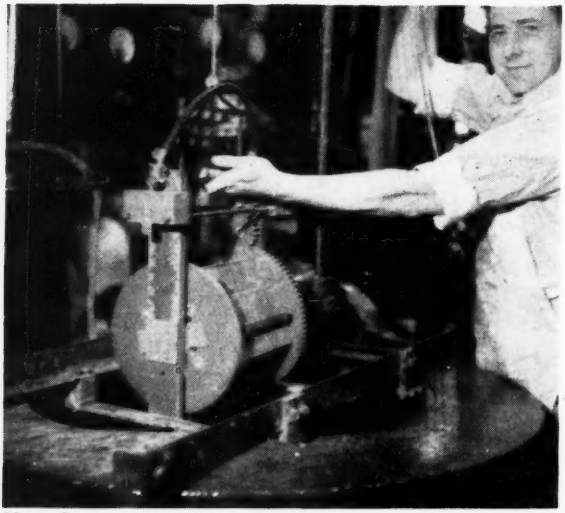

Photo Courtesy New Haven Clock Co.

Fig. 30 — A small compartment gold plating barrel.

that it is physically masked by intimate contact with other parts of the load. Again, because of high resistance, poor contact and local couple action, parts of the load may be below the potential required to discharge gold ions or they may be out of contact even if they have an area available. In short, only a definite, fixed fraction of the load in the plating barrel can be plated at any given moment. What the size of this fraction is, depends purely on the design and shape of the plating barrel, electrical characteristics and the type and form of the load.

Knowing then that we can only plate a part of the load at any given instant, the question then becomes one of designing the barrel so that true mixing occurs; that is, each and every surface of the load will be exposed equally to the current for approximately equal lengths of time during the course of a run. When we deal with a large number of objects, we immediately think of statistics and probability, a study of which subject would prove helpful in the design of plating barrels.

Take the case of the man who had a 15 per cent plus or minus error in the distribution of gold on his buttons. Let us assume he has to put on exactly 1 grain of gold on each button (actually much less is required) and the barrel load consists of 1000 buttons. This means we have to plate out 1000 grains of gold. Knowing the cathodic efficiency of the barrel by previous experiment, we can adjust and control our current and time so that 1000 grains of gold will be deposited on the load. But how will these 1000 grains be distributed? Ah! You shouldn't have asked me that, mister.

Ideally, if perfect mixing occurred there would be 1 grain of gold on each button. If we plotted the distribution of the 1000 grains of gold on the 1000 buttons we would get a straight vertical line AB as shown on the graph in Figure 29 going up to 100 per cent load. The actual distribution curve, if we analyse the gold content of each and every button, would look something like CDE (the 15 per cent error noted by our plater was undoubtedly exceeded, since he based his results on only a few analyses). The curve CDE has been plotted as a curve instead of a series of discontinuities because when we

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deal with large numbers in cases like these we are mathematically justified in doing so and thereby shows that the mixing was only fair since it indicates that about 20 per cent or more of the load was exposed to the current less than 2/3 of the operating time. This curve would be only one of the possibilities. Suppose, for example, the barrel was so poor mechanically or electrically that a large number of pieces were only in partial contact during its operation, our distribution curve would look something like FGH. Indeed, from a study of these common statistical distribution curves a great deal could be learned about barrel behavior and characteristics.

The area under the curve CDE to the right of the 1 grain abscissae shows where gold is wasted by overplating, and the amount of gold that is actually wasted can be computed from the curve or statistics. The area to the left of the .9 grain abscissae (we are permitted a 10 per cent tolerance) is sheer economic waste also since all these buttons will have to be plated again.

On the basis of a distribution curve such as CDE it might not pay a manufacturer to get this type of plating barrel as it would waste gold at too high a rate. This would hold true, even in flash plating since in order to get a gold color on the pieces that are least frequently available for plating we would have to waste a lot of gold on the pieces that are most frequently available. A distribution curve of this type is one common to a number of barrels, particularly barrels designed for other purposes than plating gold, that have been pressed into service, because of the lack of better equipment.

Fortunately, barrel design has been considerably improved in the last couple of years; gold plating barrels in particular have been greatly improved. The writer knows of a concern whose gold plating barrels show deviations of less than 2 per cent. The distribution curve for this barrel LMN closely approaches that of the ideal AB and in fact is mighty near perfect and is superior to any deposit

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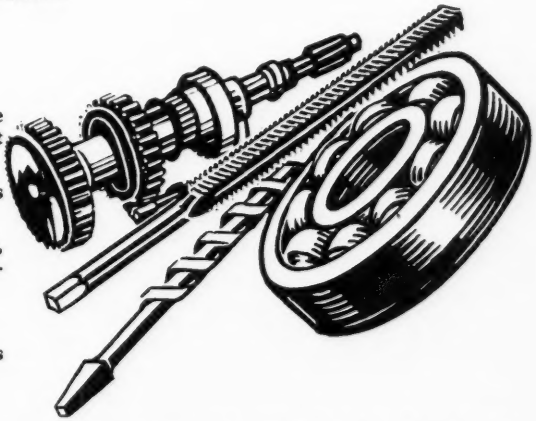

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distribution that can be obtained commercially on wires or racks in still tanks. But here barrel design is gone into very carefully; a new design is worked out for every different type of load. For most purposes, however, a deviation of 5 per cent can be considered very good and there are barrels on the market today capable of such uniform mixing and distribution.

With regard to color variations and contamination in barrel gold plating, it is true that these factors assume more prominence than in still tank plating, but they can be entirely eliminated if proper precautions are taken. As pointed out above, part of the time the work is in the barrel it is not available for deposition and is therefore subject to direct chemical attack by the electrolyte. Naturally if the barrel solution is high in cyanide, the brass is immediately attacked and copper and zinc go into solution at a fine clip and soon we have to dump the both. Then, if the barrel design is poor and the pieces do not remain cathodic often enough some of the gold that is plated on will be dissolved off by the cyanide with the result that you get gold films thinner than a wavelength of light and the accompanying interference (rainbow) colors.

The simple and efficient remedy that cures the contamination ill is to increase the alkalinity if need be and nickel plate the work before it goes into the barrel. The nickel is practically insoluble in alkaline cyanide solution, so does not contaminate the solution.

The remedy for getting more uniform color on the work is the same as that for getting a more uniform gold distribution: by improving the electrical and mechanical characteristics of the barrel so that every part of the load stays in perfect contact with the cathode, and is truly mixed.

(To be continued)

Erratum: The rights to the Bek Process are controlled by the E. G. Bek Corporation and not by Weisberg Laboratories as stated in Part 6.

Gardner Grinding and Polishing Machinery is the subject of a catalog consisting of a series of bulletins which is now being issued by Gardner Machine Co., Beloit, Wis. Designated as the No. 35, the catalog illustrates and describes disc grinding machinery, special grinding machinery, automatic grinders, ring wheel grinders, ball bearing polishing lathes, heavy-type G. I. A. discs, glue-bond abrasive discs, ring wheel chucks, fixtures for grinders, disc wheel cement, A & C grinding compound, disc grinder grease, and all types of accessories.

Copy of Catalog No. 35 free to plant engineers and managing executives upon request.

Schauer Speed Lathes. Schauer Machine Co., 2060 Reading Rd., Cincinnati, Ohio, is now issuing a 24-page illustrated circular, designated as the No. 400, which illustrates and describes the Schauer complete line of high production, bench and pedestal speed lathes especially designed for finishing, polishing, burring, or lapping small parts. The line includes standard series units as well as new variable-speed lathes and lathes with vacuum-type holding fixtures. Complete specifications are included in the circular, copy of which can be obtained free upon request.

Lyon Hydraulic Lift Truck. A bulletin designated as No. 117 and describing Lyon Hydraulic Lift Trucks is now being issued by Lyon Iron Works, Greene, N. Y. The Lyon Hydraulic Lift Truck is available in the pallet type for both double-faced and single-faced pallets.

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Frank J. Tone

FRANK J. TONE, *President*,
THE CARBORUNDUM COMPANY,
NIAGARA FALLS, N. Y.

Plating to Specification--Part 3

By DR. C. B. F. YOUNG[1]
and
EDMUND ROSZKOWSKI[2]

In this artice, the authors present nomographs for use in specification plating. A nomograph is a graph that enables one by the aid of a straight edge to read off the value of a dependent variable when the value of an independent variable is given.

IN two previous papers appearing in PRODUCTS FINISHING, (3) and (4), specification plating was discussed and thirteen tables were presented which show the time required to produce a given thickness of deposits at various current densities.

In the present paper it is the purpose of the authors to enlarge upon this data and at the same time take into consideration other variables which affect specification plating and the economics involved. In order to present this material in a simple, concise and usable manner it has been necessary to resort to nomography, a method which enables one to solve problems which involve two or more variables, by means of graphs. This interesting method is used quite freely in branches of science such as mathematics, chemistry, and physics. The simple relationship of Ohm's Law has been chosen to illustrate this method and will be discussed in detail.

At least two methods can be used in solving problems by means of graphs. The first type, illustrated in Fig. 1, has two parallel lines connected by a diagonal. Ohm's Law can be expressed as follows: $E = IR$, where E = Voltage, I = Current, and R = Resistance. If the left line in the graph represents the voltage and the right line the amperage, the diagonal can represent the resistance. The two parallel lines are equally subdivided.

The calibration of each parallel line starts at the point of intersection with the diagonal. In Fig. 1, the voltage is calibrated from zero to ten volts and the amperage is similarly calibrated. These two being chosen automatically, the calibration of the diagonal is established automatically. This can be obtained by substituting values of E and I in the above equation and solving for R. Referring to the graph, the next step is to locate this point on the diagonal. This can

1. Head, Institute of Electrochemistry & Metallurgy, New York City, and Consultant.
2. Research assistant, Institute of Electrochemistry & Metallurgy.
4. Vol. 3, No. 1, October, 1938, PRODUCTS FINISHING.
4. Vol. 3, No. 7, April, 1939, PRODUCTS FINISHING.

be accomplished by drawing a straight line, called a "tie line," between the two points involved on the parallel lines.

Let us assume in the above case that E = 2 and I = 2. Thus R = 1. On drawing a tie line from two on the voltage to two on the current, the point of intersection of the tie line and the diagonal will automatically become one Ohm. To show that the point holds for other values, assume a current of 6 amperes at 6 volts. Again the tie line falls at the point calibrated as 1. If now the following values are assumed: 10 volts, 5 amperes, 2 Ohms by Ohm's Law, and the above repeated another point on the diagonal will be obtained. If similar sets of data are assumed and the above operation repeated the whole diagonal can be calibrated.

From Fig. 1 it can be seen that whole units, for instance, 1 to 2, is further subdivided so that the graph becomes more accurate. Thus, 1.7

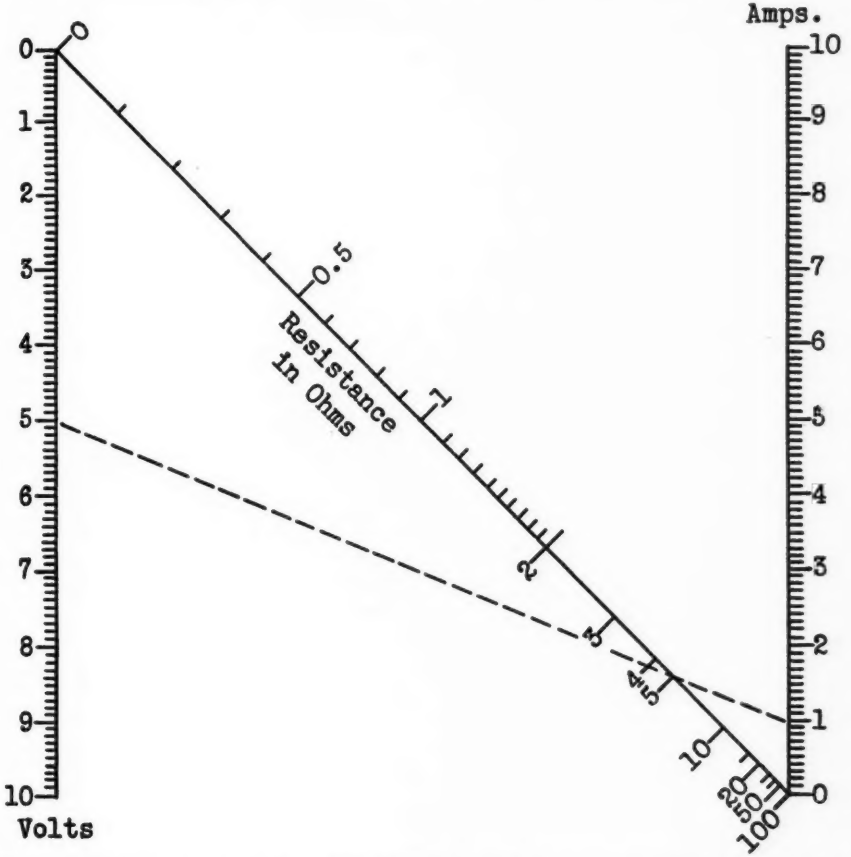

Fig. 1—Graph with two parallel lines representing voltage and current respectively connected by a diagonal line representing resistance.

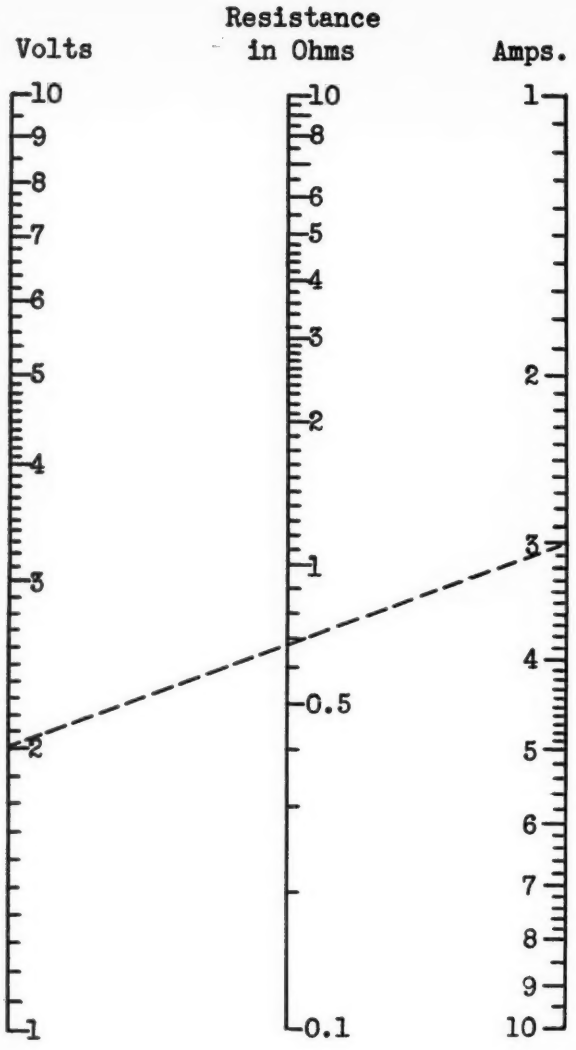

Fig. 2 — Graph with three parallel lines representing voltage, resistance, and current respectively.

volts is one division plus seven subdivisions.

The scope of this graph can be enlarged by merely multiplying the voltages by ten or any power of ten, namely 100, 1,000, and so on. For example, multiplying the calibration on the voltage line by ten, the range then becomes 0-100 instead of 0-10. The diagonal calibration automatically becomes ten times as great. The same applies to the line representing the current.

It must be kept in mind that once the graph is obtained any two variables will automatically fix the third variable. For example:

R = 5.
I = 10.
E by the chart = 5.
R = 7.
E = 3.
I by the chart = 0.43.

The second type of graph is obtained by having three parallel lines. In Fig. 2 considering Ohm's Law as before, let the left line equal the voltage and the right the amperage. The middle becomes the resistance line. The two outside lines are calibrated logarithmically to an assumed scale. If the two variables are multiplied by each other, the calibration of each line is in the same direction. If one of the variables is divided by the other, for example, R = E divided by I, the cali-

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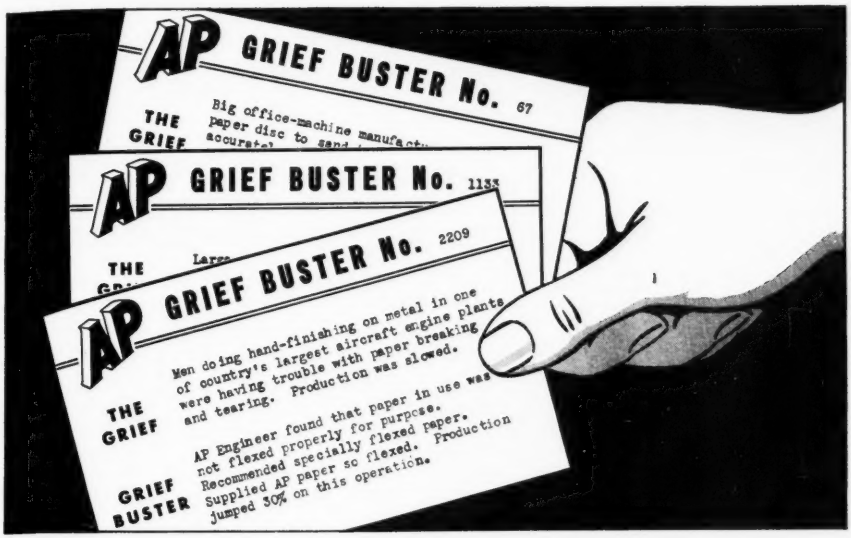
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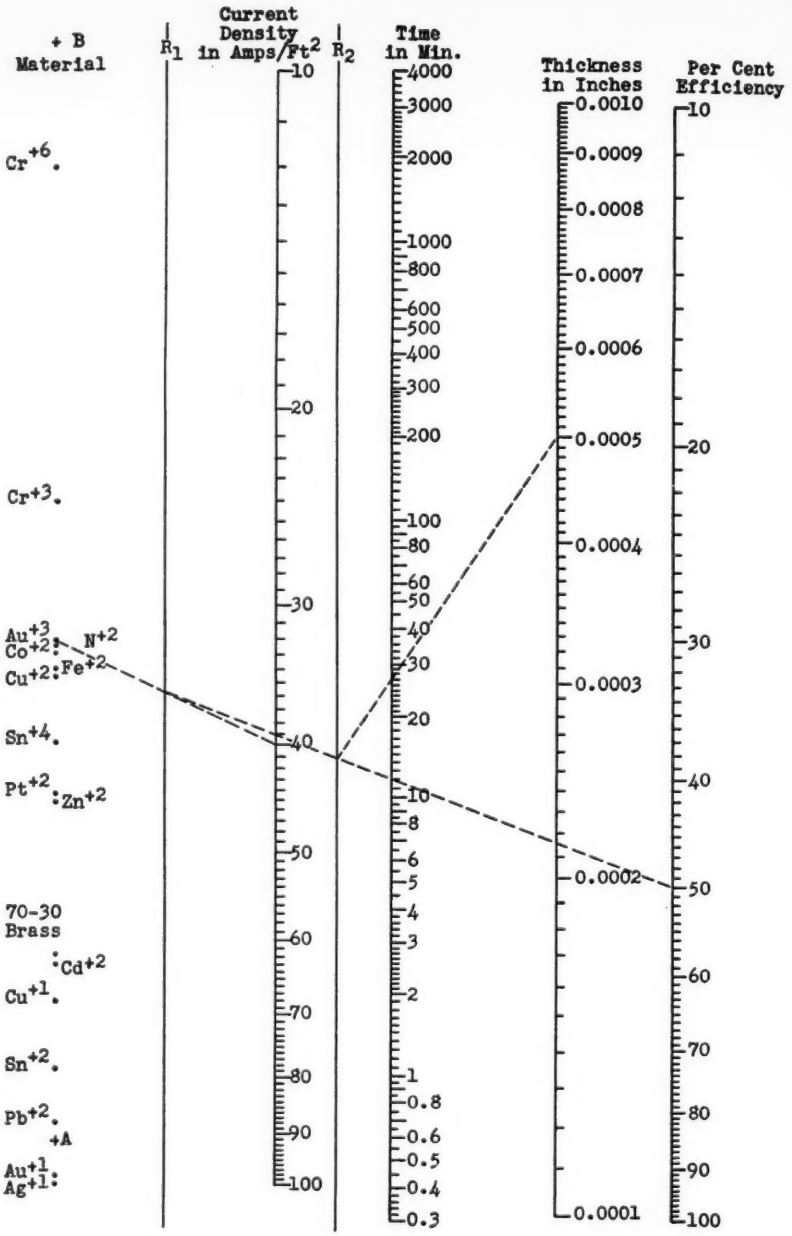

Fig. 3—This graph illustrates the method employed to obtain the time required to produce plating of a given thickness when the cathode efficiency, current density, and material used are known.

bration will be in the opposite direction, as shown in Fig. 2. If the two outside lines are calibrated logarithmically, the third one will be also.

In the case of any three variables, if two are fixed as to calibration and location, the third is automatically fixed in the same respect. In this case, a new factor will have to be introduced which is the modulus and is defined as the length in inches of the scale of the variable divided by the logarithm of the fraction obtained by dividing the highest value by the lowest value on the scale. Using the voltage in Fig. 2 as an example we can obtain the modulus as follows:

Highest value on scale = 10 volts.

Lowest value on scale = 1 volt.

$$\frac{10}{1} = 10$$

Logarithm of 10 = 1.

Length of scale = 5 inches.

$$\text{Modulus} = \frac{5}{1} = 5.$$

The same reasoning applies for the current scale.

The next step is to locate the resistance line in relation to the other two variable lines. The distance between the resistance and the voltage scales is fixed and depends upon the moduli of the voltage and current scales. It is given by the expression, "the distance between the resistance and voltage scales is equal to the product of the distance between the current and voltage scales and the fraction obtained by dividing the modulus of the voltage scale by the sum of the moduli of the voltage and the current scales."

The distance between the voltage and current scales is arbitrarily fixed at three inches. The moduli of the voltage and the current scales, as has been pointed out earlier, are five. Thus, the fraction obtained by dividing the modulus of the voltage by the sum of the moduli of the voltage and the current scales is $\frac{5}{5+5} = \frac{1}{2}$. Thus, the distance between the resistance and the voltage scales which is equal to the product of this fraction and the distance between the current and voltage scales is $\frac{1}{2} \times 3 = 1.5$ inches.

The third step is to place the calibrations in their proper places on the scale. This is performed by choosing two of the fixed variables, that is, 3 volts and 3 amperes with the resultant 1 Ohm. This point is located at the intersection of the resistance scale and the tie line connecting the two points.

The next and last step is the calibration of the resistance or middle scale. The modulus of the resistance scale is dependent on the moduli of the voltage and current scales. This relation may be stated as follows: "The modulus of the resistance scale is equal to the product of the moduli of the voltage and current scales." Since the moduli of voltage and current scales are equal respectively to 5 and 5, the modulus of the resistance scale according to the above relationship is equal to 2.5. Starting from point 1 on either side, a division is placed on the scale which is 2.5 inches from this point. It will be recalled that the modulus of this line is 2.5. Thus if the upper point is labeled 10 and the lower 0.1, the logarithm of the fraction obtained by dividing the higher by the lower is 2. By definition of the modulus, the length of the scale in inches equals the product of

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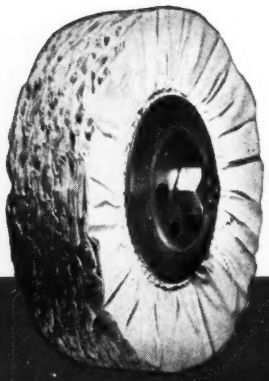

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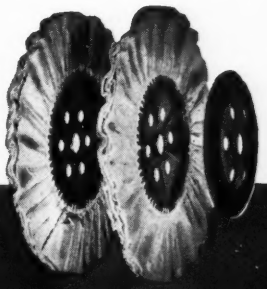

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the modulus of the scale and the logarithm of the fraction just obtained, which is 2. Since these three points are located, the scale can now be fully logarithmically divided and subdivided.

The scope of the scale can be enlarged to cover more ground or be decreased to be more accurate if desired. This is accomplished as previously explained by using 10 to any power. It must be kept in mind that if one scale is changed and the second is left in the original form, a change in the third scale will be necessary and must be expressed by some power of ten. All changes must be such that Ohm's Law is always satisfied. It must be kept in mind that the relationship can be used to determine a third variable provided any other two are given.

This form is favored when there are more than three variables involved because the calibrations of all scales are logarithmical. The only variation involved is that of the modulus. In Fig. 1 only two of the scales are regularly calibrated and the third is irregularly calibrated. That is, the space of a division is always the same on the regular scale while this varies on irregular scales. If a fourth variable is involved, the scale must be subdivided in the same irregular manner. The result of these four variables will be on a scale which is more irregular than the existing one. This would lead to complications.

By means of Fig. 2, let us calculate the resistance of a system having a voltage of 2 and a current of 3 amperes. With a straight-edge, place a tie line on the values of the two variables given. It will be noticed that the tie line intersects the resistance line at 0.67 Ohms. Thus, the resistance is 0.67 Ohms. Now that the application of the line graphs has been illustrated let us apply this knowledge to the solving of problems involved in specification plating and the economies of plating. The form shown in Fig. 2 is used for reasons given above.

By means of the graph illustrated in Fig. 3, we will determine the time required to produce a plate having the following information given: (1) thickness, (2) cathode efficiency, (3) current density, and (4) material. The thickness of a plate is dependent upon the following variables: (1) time, (2) current density, (3) cathode efficiency, (4) density of material, (5) area plated, and (6) the electrochemical equivalent. According to Faraday, 96,500 coulombs will deposit one equivalent weight of material at 100 per cent cathode efficiency. A more usable form of this law can be stated as the weight of a given material deposited is equal to the product of the electrochemical equivalent in grams, current, amperes, time in seconds, and the per cent cathode efficiency. This may be represented as follows:

$W = ZITE$ where W = weight of material deposited in grams,
E = cathode efficiency,
Z = electrochemical equivalent,
T = time,
I = current in amperes.

The weight of the material deposited is equal to the product of the volume and the density and since the volume is equal to the product of the area plated and the thickness, the above relation can be simplified to the following form:

$Atd = ZITE$, where A = area, t = thickness, d = density.

Thus, $T = \frac{Atd}{ZIE}$.

The factors A and I appear in the above formula as $\frac{A}{I}$ which is noting more than the reciprocal of the current density per unit area or amperes per square foot. The cathode efficiency is given in terms of per cent, the thickness in inches, the time in minutes. The factors d and Z are used in the form $\frac{d}{Z}$ as shown in above relation. They are constant for a given material with the density given in grams per cu. cm. and electrochemical equivalent in grams.

Keeping in mind the previously discussed principles, Fig. 3 has been constructed. Observing the material scale, points are indicated with corresponding symbols of some plateable elements. The points represent the numerical value of $\frac{d}{Z}$. The densities used are those given in the two previous articles in this series. For materials that were not listed in these articles, the densities used are those found in Lange's Handbook of Chemistry, second edition, pp. 54-59. The values range between 10,000 and 100,000. Two points marked A and B respectively are provided for those who want to include additional points in this chart. The other scales are self-evident from the tables.

Another point to observe is that there are two points labeled Cr^{6+} and Cr^{3+}. These two points are provided to distinguish between hexavalent and trivalent chrome baths. The same distinction is provided for other metals which have more than one valence.

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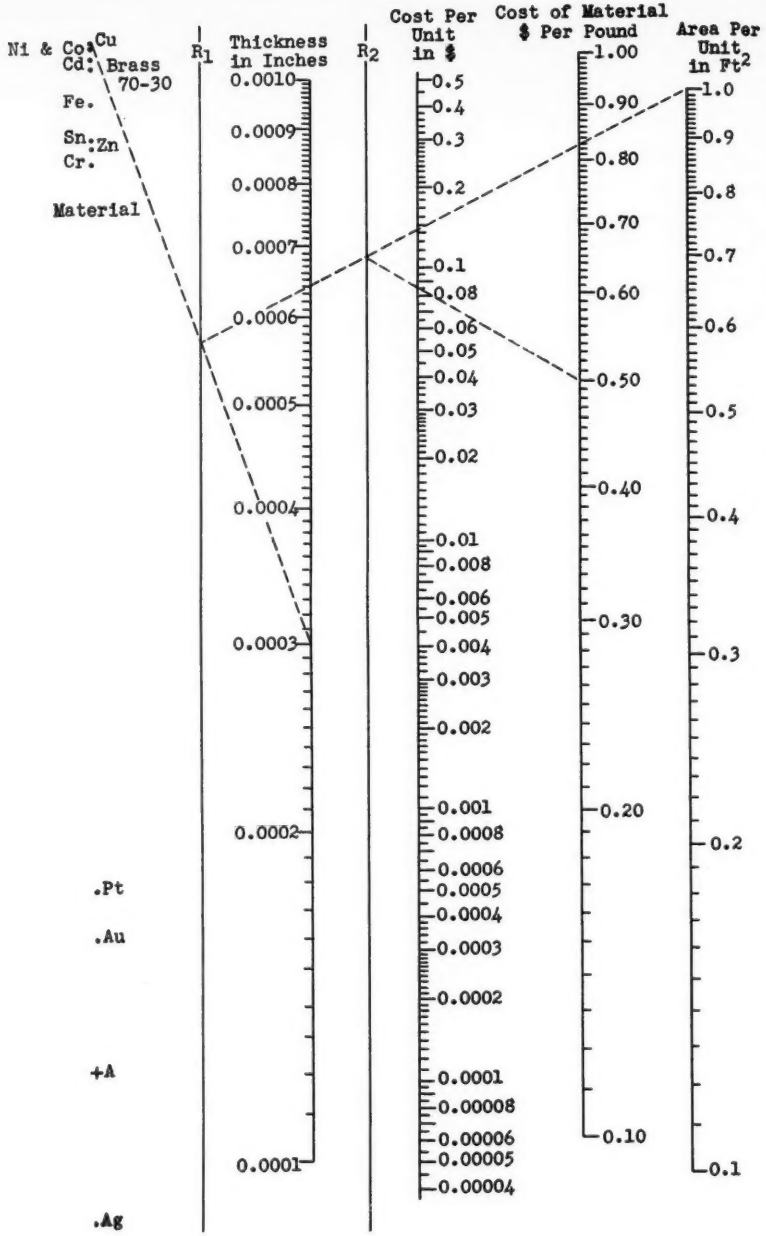

Fig. 4—This type graph is recommended for determining the cost of the material used in the plating operation.

The only remaining explanation required of the graph is the mechanism of use. A definite material, a given current density, per cent cathode efficiency, and thickness are chosen. If the time of operation is required to produce a thickness of 0.0005 inches from a trivalent gold bath operating at a current density of forty amperes per square foot and 50 per cent cathode efficiency, the following procedure is involved. A tie line is drawn betwen the trivalent gold point and the current density. The intersection of this tie line with the line marked R_1 is connected by another tie line with the cathode efficiency line of the bath. The intersection of this second tie line with the line marked R_2 is connected by a third tie line with the thickness of the plate desired. The intersection of this third tie line with the time scale gives the time required, which is, in this case, equal to 27.2 minutes.

The lines R_1 and R_2 in Fig. 3 are simply the results of graphic calculations and do not have to be calibrated. Thus, the intersection of the first tie line with the line marked R_1 if it were calibrated, would give the value of $\frac{d}{ZI}$. The intersection of the second tie line with the line marked R_2 would give the value of $\frac{d}{ZIE}$. The scope of this graph can be enlarged by using powers of ten as in the case of previous charts. Thus, if the thickness desired is .1 of that on the scale, the values of the scale can be divided by 10 with the resulting time being .1 as long. The same applies to all other factors.

With further acquaintance of the graph it is possible to perform the operations involved in any particular

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manner. Thus, for example, if the current density in the above case is required, the following procedure would be followed. The given values on the time and thickness scales are chosen and a tie line is drawn through them and continued until it intersects the line marked R_2. A tie line is drawn through this intersection and the given value on the cathode efficiency scale and extended till it intersects the line R_1. A tie line drawn through this intersection and the part marked Au^{3+} if extended till it meets the current density scale will give the current density desired.

Figure 4 can be used to determine the cost of the material used in the plating operation. This graph does not include electrical energy charges, labor and maintenance charges, or plant amortization charges. This graph is provided for use in office estimates. Another graph is shown in Fig. 5 which is applicable for actual plating room estimates.

The basis of the graph Fig. 4 is the cost of material required to produce a given weight of plate. To simplify matters, unit costs are considered. The term "unit" will be defined as that number upon which calculations are determined, i. e., one, one dozen, one gross, and so on.

The cost per unit is equal to the product of the weight of plate and the cost of the material. Since the amount of material in the plate is equal to the product of the area plated, thickness of plate and the density the above relation can be expressed as:

Cost per unit = area of unit x thickness x density x cost of material used.

The scales in Fig. 4 are self-explanatory except for the one labeled material. In this case the points located are placed according to their densities in grams per cu. cm. Since the density of material is not dependent on the bath, only one point is indicated on the chart for chromium, and so on. Point "A" is shown to give the point from which calibration has been made and its value is one. It will be noted in the material column, gold, platinum, and silver are located near point "A" which value is one, while the base metals are higher in the column being near seven. This column is based on the density of material as already mentioned.

The difference in cost of the precious and base metals on a pound basis is so tremendous that it would be impractical to represent both on a single sheet. To avoid complication, the costs of precious metals are calculated on the troy ounce basis while the base metals are calculated on the avoirdupois pound. Thus the points for the base metals represent the actual densities of those materials. The points for the precious metals represent the densities divided by the number of troy ounces in an avoirdupois pound, which is 14.583.

The mechanics involved will be shown by determining the unit costs of a copper plate of 0.0003 inch thickness on a unit area of 1.0 square foot at a material cost of $0.50 per pound of copper plate produced. The first step is the connection of the point labeled as Cu with the 0.0003 in. point on the thickness scale by a tie line.

The intersection point of R_1 is now connected with a second tie line to the point one on the area per unit scale. The last step is the connection of the intersection of the R_2 line with the point 0.50 found on the cost material scale. The answer is found at the tie line intersection with the cost per unit scale which is $0.085. The effect on the scope and the mech-

anism of use is the same as in previous graphs.

The graph Fig. 5 is constructed so as to calculate costs from operating data. In this case also the basis is the cost of material required to produce a given weight of plate. From the previously stated Faraday's relation the weight of plate produced equals Z x I x T x E. Thus, the unit cost in this case is equal to the product of the weight of plate and cost of basic material. All these factors have been combined to give Fig. 5.

Most of the scales involved are self-evident. The extreme right scale is calibrated for two factors. The points located on the material scale, in this case, are placed according to the electrochemical equivalent. The point from which calibration proceeds is labeled "A" and represents a value of 0.0001. The only exception is that of the precious metals where the cost of the basic material is given in terms of cost per troy ounce. Thus, the Z is divided by 14.583. In order to bring the value of auric and aurous gold on the scale, the actual values of

$$\frac{Z}{14.583}$$

have been multiplied by two for auric and by six for aurous gold. Therefore, when results are obtained they are either two or six times too high. Thus, the answer obtained for gold from Fig. 5 is divided by the appropriate factor as shown in the chart by the note.

The mechanism of using graphs is explained by finding the cost of nickel plate produced at a current of five amperes per unit at a cathode efficiency of 40 per cent for a period of 30 minutes at a basis cost of material of one dollar per pound. The first tie line is drawn between the point on the material scale labeled Ni^{2+}

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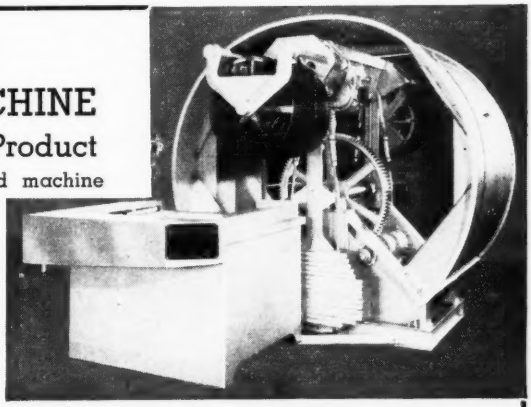

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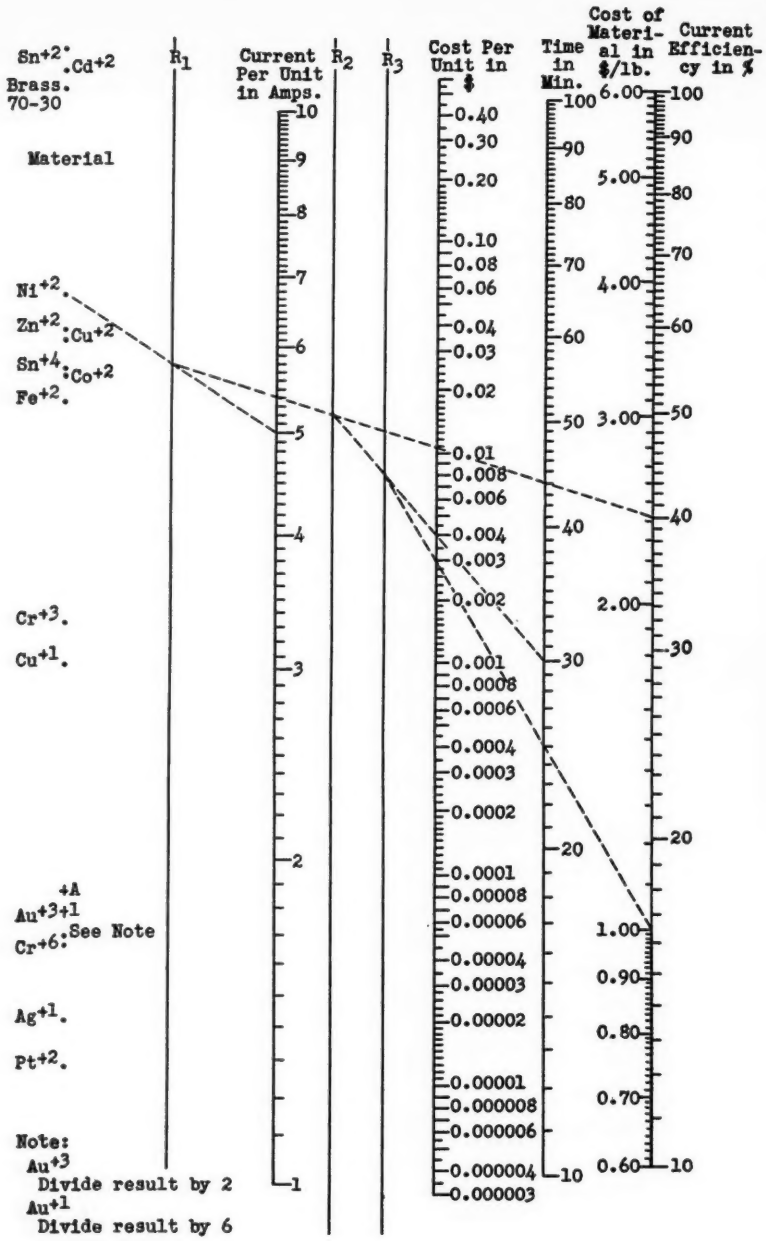

Fig. 5—Costs from operating data can be calculated by means of this type graph.

and the value 5 on current scale. A second tie line is drawn between the value 40 on the efficiency scale and the intersection of the first tie line and the line labeled R_1. A third tie line is drawn between the value 30 and the time scale and the intersection of the second tie line with the line labeled R_2. A fourth tie line is drawn between the value of one dollar point on the cost of material scale and the intersection of the third tie line with the unit cost scale gives the desired result, which is $0.003.

In regard to the scope and the mechanism of operation, the same rules apply here as before. One precaution to observe is that the current efficiency scale **must be linked** with line R_1 while the cost of material scale **must be linked** with the R_3 line.

The final graph, Fig. 6, is provided for the calculation of energy cost involved in plating. The power consumption is expressed as $P = VIT$, where P = Power, V = Voltage, I = Current, and T = Time. Thus, the cost of power consumed equals VIT times the cost of energy. From this relation, graph Fig. 6 has been derived.

The mechanism of operation of this graph is explained by the solution of the problem with the following factors: $V = 6$, $I = 5$, $T = 40$ minutes, cost of energy = .03 cents per Kw. hr. The first tie line is drawn between the value of six on the voltage scale and the value 5 on the current scale. A second tie line is drawn between the value 40 on the time scale and the intersection of the tie line with the R_1 line. A third tie line is drawn between the value of .03 on the cost per Kw. hr. scale and the intersection of the second tie line with the R_2 line. The result is given by the intersection of the third tie line

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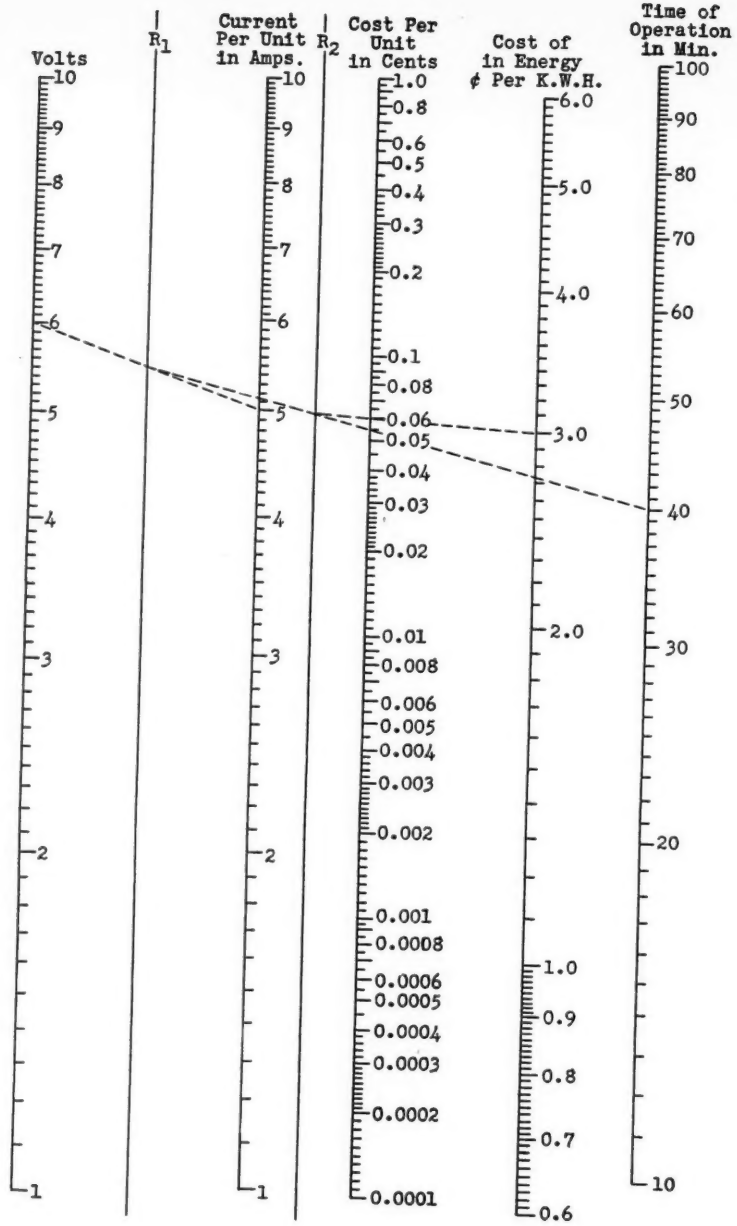

Fig. 6—The energy cost involved in plating can be calculated by means of this graph.

with the cost per unit scale, the result being .06 cents.

In conclusion, the authors would like to say that at first glance the graphs will appear highly theoretical and not at all practical. However, upon use it will be found that the material presented will provide many short cuts and also prevent many laborious calculations. Once a man becomes familiar with the use of the graphs, time will be saved and mistakes avoided. It should be kept in mind that any of the factors listed as a scale can be determined, provided conditions are known.

Proceedings of Fifth Annual Forum. The Porcelain Enamel Institute, 612 N. Michigan Ave., Chicago, Ill., has recently issued the proceedings of the Fifth Annual Forum. This book comprises the papers which were presented at the meeting held in October at the University of Illinois. It also includes complete reports of the discussions.

American clays and their use in enamels is one of the most important subjects discussed. Five men from the industry and the schools presented the latest developments indicating that the porcelain enameling industry need no longer depend on German clays.

The most important part of the volume is the discussion of the Board of Experts. Here in 20 pages are given the answers to most of the 127 questions which were presented. This board represented all branches of the industry, enameling plants, frit making, iron and steel making, and chemicals, as well as schools. No more important group of men could have been assembled from the industry.

Other general subjects are discussed and the work of the Institute's Research Fellow at the National Bureau of Standards is included. This publication will be of interest to everyone connected with the porcelain enameling industry as it represents the best thought of the technical and operating men. Further, it is most timely as it so closely follows the actual meetings.

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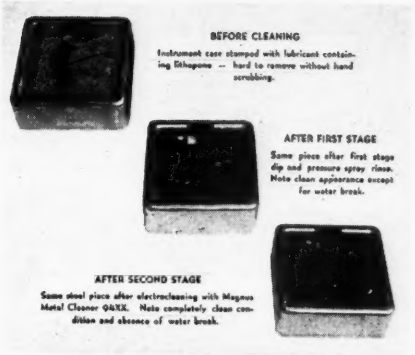
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Barrel Finishing of

A Further Discussion of Surface Removal in Precision Operation of Barrels

By H. LEROY BEAVER
Barrel Finishing Consultant
Lansdale, Pennsylvania

IN the two papers immediately preceding this, the removal of surface from metal products in barreling operations obtained by continuous pressure as compared with the removal of surface by the action of impingement was discussed at some length in order that the reader might differentiate between the final results obtained by these operations. Both abrasion and impingement are only a part of the barreling process which we might designate as the "Cutting" part of a "cut and color" operation performed with a wheel and abrasives.

Having lived with this subject for more than thirty years, it still seems a bit strange to the author just why so many barrel operators insist on predicating their opinion of barrel finishing generally by the results which would ordinarily be obtained in the operation of the old style foundry rattler wherein castings were tumbled about to remove fins and partings as well as to shake out core material. When we tell them that instead of being a sort of makeshift or slipshod operation for more cheaply producing a surface lustre, that a properly designed and operated burnishing barrel is in truth and in fact a precision instrument even to a far greater extent than many machine tools that are so rated, they simply look at you in almost unbelievable astonishment, yet such is the fact.

In substantiation of this claim, let us examine high carbon chrome alloy steel balls of the type regularly assembled into high speed high precision radial and thrust bearings. We know of no case of steel ball manufacture in which the final or precision finish is not obtained by barreling process and indeed without this process such bearings as we all know them today would be impossible to manufacture. No other method of finishing steel balls has ever been developed that could even in the most remote sense be considered as either mechanically possible or commercially practicable. It is true that fairly accurate balls may be formed in what are known as precision grinding machines specially developed for the purpose, but their use today is only in forming the blanks for the finished product. To most mechanics, accuracy in thousands is considered close

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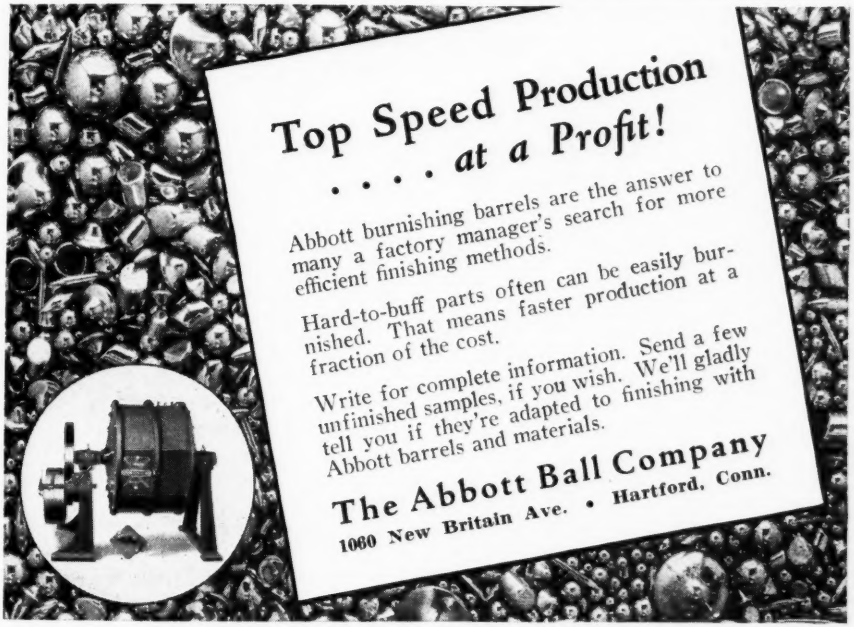
work, but when we consider that in ball bearings the tolerances must be far closer, we find that rather than being an unusual thing, accuracies for even ordinary requirements are held in most cases to within .0001 in. For a higher type high speed bearing, diameter accuracy of .00005 in. is the rule and such balls are held accurate in sphericity to within one-fortieth thousandths of an inch. It is entirely possible to produce balls wherein the diameter accuracy may be held to within the one two hundred thousandth of an inch. This, of course, is not attained in a single operation. The blanks on being rounded to form are first tumbled with coarse, then finer abrasives until they are reduced to size within from .0001 to .00015 in. plus to the finished size. From this point on and in a single operation the time element, the ingredients used, the barrel speed and the load limit are calculated so that the size can be controlled within fractions of a ten thousandth of an inch until an absolutely accurate size is reached.

It is obvious, of course, that any barrel operations as the above cannot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be performed where the mass is thrown about in all directions due to high barrel speeds. The speed of the barrel must be controlled in such a way that the action is obtained by pressure exerted by the mass as it flows around the center of the axis of the barrel.

The simplicity of the operation of attaining the high degrees of accuracy does not even require technically trained or skilled labor, because the average employee can easily operate a number of barrels and still maintain constant supervision over his tolerances. Parts operated for precision are generally held to lots of approximately three hundred pounds per batch, and the operating time required to reduce surface area, for example, on a ½ in. steel ball of one to one and one half ten thousandths will be anywhere from eighteen to twenty four hours of continuous operation.

The value of barreling operations in cases like these must be obvious even to the uninitiated because, even though we have machines that will handle a single ball being lapped into the seat of, for instance, an oil well valve, single operations would render the cost of any ball bearing prohibitive if production was sought by that method.

All that we have said in this connection with respect to round balls for ball bearings, can also be said in large part for the production of rollers for roller bearings. The roller blanks are first cut to size, and then in addition to machining operations, they have several barreling operations. Their final finish, which also embraces the control of their accuracy to size is a barreling function, and is also the creation of the radii on the edges of the rollers.

The question now arises, what is the best type and size of barrels to use for work of this character and here we have a wide variation in opinion. Some hold that a comparatively small barrel will do as well as a large barrel, and some say that an oblique tilting type is equally as effective as a high and narrow type or long and narrow type of barrel. Speaking from an experience of more than fourteen years spent in the precision operation of various types and sizes of barrels, we would say that for all-purpose tolerance work, barrels may be safely of an average of thirty inches in diameter and range from eight to sixteen inches wide. Such barrels, however, when used in this way are loaded differently than when used for burnishing work where only a superficial surface finish is desired, or even where the more important factors of work hardening to close pores and provide resistance to corrosion and hardening surface to resist wear are the controlling factors.

In the last three cases the barrels may be safely loaded to two-thirds full, but in precision cutting down, the speed is reduced and the barrels only loaded to a point that could be roughly indicated as from somewhere between one third and one half full. It is important though that the high point of the load when the barrel is placed in operation will rise above a line drawn horizontally through the center of the axis of the barrel, for in this way we utilize the entire width of the barrel to get the longest flow of the mass and at the same time obtain a smoother flow of the load with far less likelihood of any effect of impingement.

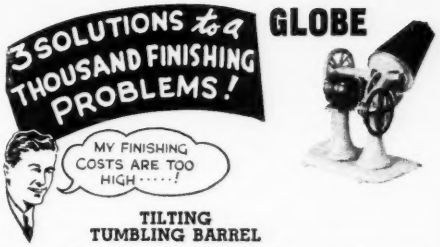
Just as we have previously described, a load mass when operated in this way will be carried up the side of the barrel and will then flow over, and as the mass passes over the center of the axis of the barrel it will sag somewhat and then again slight-

ly build up near the periphery of the barrel. The form of the flow will maintain its characteristic "kidney shaped" form which can always be noted in any open type of barrel when it is operated at the proper speed.

Our own preference is for straight side barrels, and while three may be some advantage in conical formed barrels in some of the preliminary or roughing operations, the advantage is so small as to be almost negligible. We have found that we obtain greater uniformity by using the same size and shape of barrels for each operation, whether roughing or finishing. Where production quantities warrant, the length of the barrels may be extended, thus we may have barrels of thirty inch diameter, and the width may be eight, sixteen, twenty-four, thirty or even forty inches, but the barrel size is largely predicated on the volume of production.

Only in the largest production plants are the larger barrels required, and to undertake their use where units of small quantity are the order of production would be only to repeat what we have said of some other barrels operations, namely that they were like hunting for sparrows with a cannon. We might assume, for example, that if we extended the 30 in. barrel to 60 in. diameter but retained its same width that we would do four times as much service work, but the larger diameter would not be utilized in this way, but only to provide a longer flow to the mass in production and the character of the barrel loading would follow closely the loading as suggested for the thirty inch diameter barrel.

The argument that oblique tilting type barrels are as efficient as large diameter but comparatively narrow barrels is not borne out in actual practice, either on precision or on just



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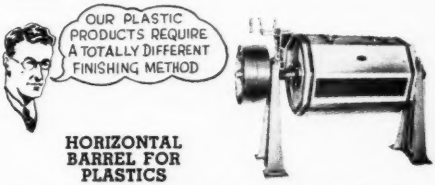

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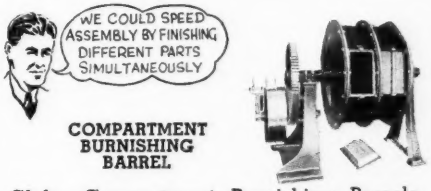

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average work. It must be realized that an oblique barrel carries the mass at an angle and that the degree of pressure varies as the mass flows toward the mouth of the barrel. We have no way of knowing to just what extent the mass is mixed as it flows around the center of what we may call an artificially created axis of the barrel, so that some parts might remain well toward the front of the barrel and receive very light pressure, others might remain substantially in the center of the flowing mass where they would receive the maximum of pressure and still other parts lying closer to the bottom might receive little or no pressure depending solely on just how heavily the barrel is loaded and the angle at which it is operated.

It is certain that no oblique tilting type barrel should ever be operated in such a way that the load completely covers the bottom of the barrel, nor should the load be carried higher up the side of the barrel than one inch and preferably three inches from the top, nor should the load approach nearer than three to four inches from the lip of the barrel. When a barrel manufacturer gives the capacity of a barrel as four bushels, this does not mean that a load of that bulk should be attempted to be used. This simply indicates the cubic content of the barrel and the load will be always less in bulk than the capacity of the barrel indicates.

Now in this discussion of the use of a barrel as a precision instrument for operations requiring great accuracy, the reader will quite naturally say, "But why does not the author describe in detail the abrasives or polishing mediums used in such operations and the complete operating cycles. This, of course, could be attempted, but we hesitate to go into this because we have a fear that in many applications the information might be misleading and that the cycle intended for a given operation might be used for something of an entirely different character which would only tend to make confusion. Hardened steel, annealed steel, brass, copper, aluminum and plated and unplated metals all have their variations in not only the cycles of operation but in the character of the materials used, and if water is used where limpid or crocus finishes are desired, this also requires care because organics in the water supply that lead to pitting would defeat such finishes. For that reason, every precision case must of necessity be studied on its own merits and the proper operating cycle as well as the materials used must be selected with extreme care if the final result is to be completely satisfactory.

Precision barreling operations are invariably preceded by some machining operation wherein the parts are closely accurate for contour, size and with a given oversize tolerance to provide for material removed in the barreling sequence. Quite obviously, the average metal stamping formed from sheet cannot be thrown immediately into precision production for the reason that the punch which is used to form the part will only partially penetrate the strip material and the balance will snap off, so that we generally have a somewhat rounded contour or radii on the face of the stamping and often a burr on the back. The radii will reduce slower than the burred edge due to the fact that it has been somewhat work hardened in the blanking operation. Such parts require a preliminary machining treatment before barrel operations are commenced, but on a wide variety of fairly accurate parts

formed on screw machines, the operations are comparatively simple. Where there are angles, tips or points that have a tendency to wear away in the operation faster than the body of the part, we simply provide for this in the first forming of the part by leaving more material on the blank and very simple time cycle study will easily determine just where a blank should be increased in size to provide for removal of excess material.

Amercoat Plastic Coatings. The "Amercoat Plastic Coatings" catalog which has been issued by the American Concrete and Steel Pipe Company, Box 3428, Terminal Annex Post Office, Los Angeles, Calif., is described as being of interest to all industrial executives, and of specific value to the technically minded plant superintendent. The catalog, amply illustrated and printed in two colors on coated book stock, consists of 16 large pages, which explain in type and pictures, the diversified uses to which Amercoat may be put in modern industry. Amercoat, defined briefly as a sprayable plastic coating which is corrosion-proof and non-contaminating, is disclosed by the manufacturer's brochure as being useful and profitable for an amazing range of things.

The properties of protection that Amercoat gives, for example, are emphasized by pictures and text showing its use at sea where an ocean liner's water line strip—the "boot-topping"—is shielded from the terrific corrosive and abrasive action of wind and waves by Amercoat. Its value as a protector against contamination, as in the case of wine or other products where purity is paramount, is explained in its use as a lining for storage tanks and containers for bulk shipments. In fact, in all beverage and food containers, as well as bottling and canning machines, it is pointed out, this plastic coating's pliable, abrasion-resistant film, impervious to a long list of acids, alkalies, oils, fats and alcohols, makes it ideal.

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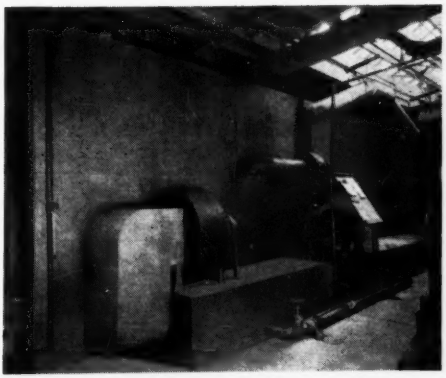

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Corronizing Thermostat Elements

By JOHN E. MacQUILKEN
Standard Steel Spring Company
Coraopolis, Pennsylvania

THE Robertshaw Thermostat Company, Youngwood, Pa., producers of precision thermostatic control units, is now in production of Corronized thermostat elements. The Corronized coating, predominately a thin non-porous nickel plate, protects the bulb end which is exposed in the corrosive oven atmosphere and thus insures a long, trouble-free life.

This process, developed by Standard Steel Spring Company, Coraopolis, Pa., is offered to manufacturers of products requiring maximum corrosion resistance. The Robertshaw Thermostat Company, which produces thermostats for every type of temperature control, has chosen this coating to apply to its largest production item, namely, the famous Robertshaw oven temperature control, which is in use in millions of homes and is now standard equipment on many products of the leading gas and electric range manufacturers.

The actual thermostat is comprised of two different sized sections of copper tubing filled with a temperature-sensitive medium which expands and contracts a small diaphragm attached by high heat resistant solder to one end of the tube. The large tube is swedged to fit the smaller one and acts as the bulb which is inserted into the oven. One end of the tube is left open for the activating medium which is forced into it by the alternate use of vacuum pres-

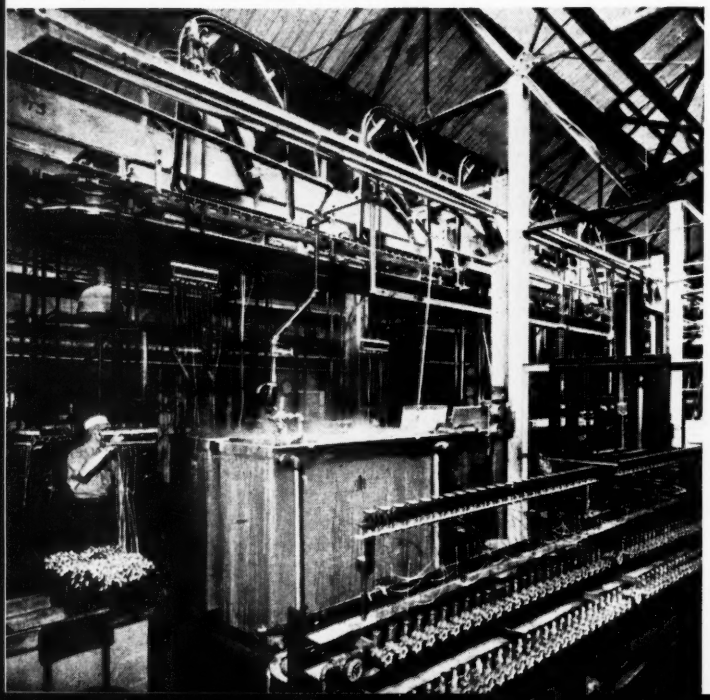

Fig. 1—A view showing the thermostats being placed on the conveying mechanism preparatory to entering the cleaning tank. One conveyor carrying the thermostats is shown entering the cleaner tank as the operator loads the next rack.

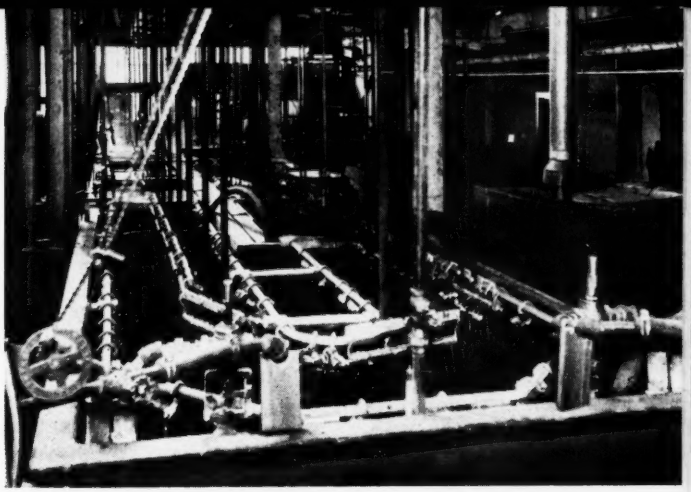

Fig. 2 — An illustration showing the nickel plating tank which is built in a V shape.

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sure, and finally sealed.

A series of checks and calibrations is again made and the units are then loaded on the automatic Corronizing plant conveyor which completes the processing cycle in approximately 40 minutes. The Corronized thermostat is removed from the conveyor and sent to the assembly lines where it is attached to valves and controller bodies which will maintain within a fraction of a degree the temperature of any heating unit.

The Robertshaw Thermostat Company, who are also electroplaters of nickel, tin, chromium, and copper, have found Corronizing to be particularly efficient for this application. They have expressed complete satisfaction with the corrosion resistance and the adhesion of the electroplate to the base metal even when the complete unit is subjected to the numerous bends and coiling operations necessary for insertion into modern, streamlined stoves.

The equipment for the Corronizing plant, which operates at the rate of over 1,000,000 parts per year, was made and installed by the Hanson-Van Winkle-Munning Company, Matawan, N. J., manufacturers of electroplating equipment and supplies.

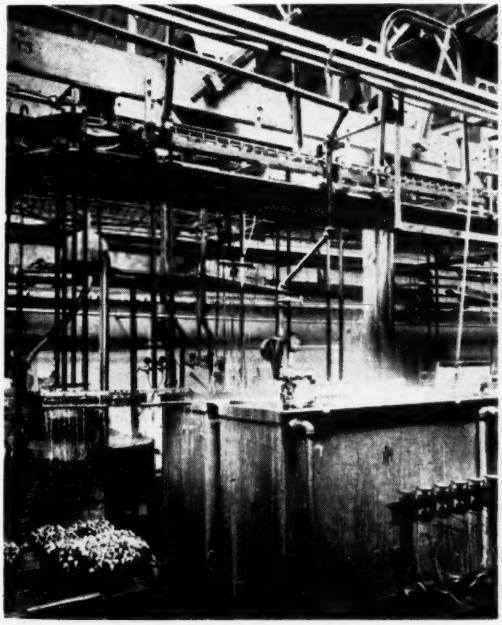

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Fig. 3 — After the conveyor has passed through all the steps in the process it returns to the position shown here.

Engineering Training for National Defense

THE need for technically trained men in the many defense industries is critical and, as the industries are becoming co-ordinated in the national defense program, is growing more acute.

An appropriation made by Congress provides for technical training in the many specialized fields essential to the defense industries—the training to be given in the engineering and technical colleges.

In accord with this plan, the Michigan College of Mining and Technology, Houghton, Mich., has set up four special short courses varying in length from 12 to 20 weeks. The courses have been designated as follows: I Machine Design; II Materials Inspection and Testing; III Engineering Drawing; and IV Protective Coatings for Metals and Metal Finishing. Each course will require 36 hours per week, or slightly more, of intensive class, lecture, and laboratory study. The courses are intended not only to train new workers but also to serve as refresher courses for graduate engineers in the field.

Only those students who have the necessary qualifications and training can be admitted. In special cases, experience in the field will be accepted in lieu of some of the training otherwise required. Applicants will be admitted to courses upon the basis of personal interviews or in consideration of a written application which can be obtained by writing to the College.

The instructional costs are borne by the government, but the student must meet his own living expenses and must provide textbooks and personal equipment (such as drawing instruments) where these are required.

The College maintains a placement department whose facilities will be available to the men trained in the national defense courses. Though no assurance of employment can be given, yet the present demand for trained technicians and engineers, and the placement department's wide acquaintance with governmental and industrial organizations, make it highly probable that suitable employment can be found. It must be borne in mind, however, that for most technical positions in the Government service the students must satisfy the Civil Service Requirements as to training and experience. For employment in industry, only evidence of proper qualifications is necessary.

Additional courses may be set up from time to time if sufficient interest is manifested in fields not covered in the courses now offered.

Course No. IV, in which the readers of PRODUCTS FINISHING might be especially interested, is intended to provide men trained in the field of protective coatings for metals and metal finishing—and primarily in the testing, inspection, and evaluation of the coatings.

IV. Protective Coatings for Metals and Metal Finishing

(Production, application, testing, inspection and evaluation.)

Too much emphasis cannot be laid upon the importance of testing and inspection in the entire field of production. Similarly, "Protective Coatings" demand careful specifications, and require close supervision and critical inspection in order to maintain uniformity of quality and the ability to meet the demands put upon them. The field is too broad and yet too specialized to be included in the general course on Materials Testing and Inspection; hence this course in Protective Coatings is offered in order to provide the special training in a field which is of great and recognized importance wherever metals are used.

Qualifications for Admission:

At least one year of general college chemistry and physics and the equivalent of one year of college mathematics (algebra and trigonometry).

Outline of Instruction and Subjects Involved:

The testing and evaluation of coatings and metal finishes is the real objective. This, however, must necessarily be preceded by instruction relating to the general scope and importance of the field, the production and application of coatings, and the factors affecting their quality, production, uniformity, and ability to meet specifications. Moreover, work in general chemistry, organic chemistry, and electro-chemistry and in general metallurgy, physical metallurgy, and related subjects will be included wherever such work is necessary to the fulfillment of the objective of the course.

The instruction, while based firmly on fundamental theory, is highly

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practical. Coatings of all types will be produced and tested in the laboratory. These include hot-dipped metals, electroplates, cementation, metal spray, organic finishes (lacquers, paints, rubber, oils, and greases), fused oxides (vitreous enamel), and chemical coatings (oxides, bluing acetate, Parker Bonderized, and so on). The amount of emphasis given to each will be determined by the relative importance of the coating to defense industries.

Length of Course: 20 weeks—40 hours per week. Starting date, March 3.

Fifty Years of Manufactured Abrasives

THIS year is the 50th Anniversary of the invention of silicon carbide —the first abrasive substance to be made by man on a commercial scale. In March, 1891, Dr. Edward G. Acheson made a crude electric furnace from an ordinary plumber's pot connected to an arc-light carbon. Experimenting with this crude furnace, he produced silicon carbide—a material which does not occur naturally in nature—and to which he gave the name "Carborundum." With the development of electrical power on a huge scale through the harnessing of Niagara Falls, Acheson moved his plant to Niagara Falls, where The Carborundum Company still operates its main works.

A few years after Acheson's invention, Charles B. Jacobs discovered a method of making aluminum oxide in the electric furnace. Aluminum oxide is the chief abrasive constituent of natural emery and corundum. Although tougher than silicon carbide, it is neither as hard or as sharp. By combining the two, Acheson was able to produce abrasives which could be varied to suit the grinding of all types of metals and other substances.

Today, after fifty years, there is no industry of any kind or character which does not use abrasives or abrasive products in some form or other. Perhaps the most important of all is the contribution that manufactured abrasives have made to mass production—a concept that has made America predominant in the mechanical arts. Through the use of the grinding wheel and the modern grinding machine, parts can be produced at incredible rates of speed and to such accuracy that they will vary, one to another, not more than a fraction of a thousandth of an inch. Such accuracy is the foundation of mass production of interchangeable parts, for which America has become famous.

Manufactured abrasives are used in the manufacture of practically every metal product. If a product is not ground or lapped for accuracy, it is almost certain to be buffed or polished for appearance. All of these operations require abrasive materials. It is apparent that the minute crystals, almost overlooked by Dr. Acheson, have had a definitely important influence on the well being of mankind.

Bristol Liquid Level Gauge Catalog. A new catalog on modern liquid level gauges is now being issued by The Bristol Company, Waterbury, Connecticut.

Float, pressure-bulb, pressure, air-bubbler, counterpoise, and differential pressure type water and liquid level gauges are described for all types of applications, including the measurement and automatic control of liquids in open, as well as in closed vessels where the surface of the liquid is under static pressure.

It will be noted in this bulletin that with these instruments the level of almost every kind of liquid—whether flowing, turbulent, corrosive, covered with ice or carrying solid matter—can be recorded, indicated, or automatically controlled without difficulty.

A copy of catalog 1015 may be obtained upon request.

Eastern Mixing Equipment Catalog. The Eastern Engineering Company, 45 Fox St., New Haven, Conn., announces a new 24-page catalog describing and illustrating mixing equipment for industrial applications.

One section of this catalog is devoted to important engineering data on the selection and adoption of mixing machinery. On these pages are discussed: power required, high speed versus low speed, single versus dual propellors, vertical versus side entering mounting and other information valuable for selecting correct equipment. This detailed data covers the essential features and advantages of modern methods of agitation.

The catalog includes complete descriptions and illustrations of electrical fluid mixers in all sizes and types, ranging from 1/1000 h.p. to 25 h.p. A section of blueprints furnishes dimensional data on various styles, such as portable, vertical, and side entering.

Another section is devoted to several related items in fluid handling, and presents in detail midget centrifugal pumps, sump pump, air powered mixers, transfer pumps, and temperature controls.

Copy free upon request.

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THE BIAS BUFF

The MARK on a Superior Buff and why This MARK identifies a buff in which cloth, construction and lasting qualities surpass any ordinary buff made. Cloth is from our own mills; it is bias cut and bias formed—never ravels nor wastes polishing compound. The buff illustrated is BIAS Buff Type "K" for heavy work; 3 sections will do the work of 5 sections of an ordinary buff. We make buffs for every polishing requirement, including BIAS Ventilated Buffs. Try them.

WARNING NOTICE. Manufacturers of buffs are warned against infringement of the claims of this U. S. Patent 2,004,623, as the owner intends to protect his right and prevent all infringement.

Look for the Name "BIAS" on the Buffs you buy

The BIAS BUFF *and* WHEEL CO., Inc.
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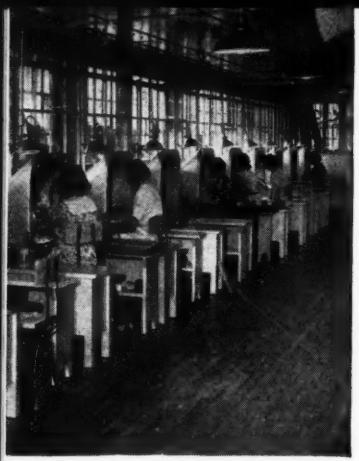

News OF THE INDUSTRY

Cowles Detergent Company Elects New Officers

At a recent meeting of the Directors of The Cowles Detergent Company, 7016 Euclid Ave., Cleveland, Ohio, the following new officers were elected: Mr. E. N. Horr, vice-president and general manager; Mr. C. C. Bassett, vice-president and director of sales; Mr. C. C. Barrett, secretary and treasurer; and Mr. C. H. Fisher, asst. secretary and asst. treasurer.

These new officers take office immediately. Mr. Horr has been with the company since 1925, most recently in charge of production and purchasing. Mr. Bassett has been with the company since 1931 and has managed the Mitchell Wing Division, Cambridge, Mass., since 1932. Mr. Barrett has been secretary of the company since 1927, and Mr. Fisher has been tax specialist and accountant since 1929.

Hammond Machinery, Inc. Appoints Assistant to Chief Engineer

Mr. R. H. Hathaway, formerly sales engineer for Production Machinery Company, Greenfield, Mass., has been appointed assistant to Chief Engineer Henry J. Kingsbury, Hammond Machinery Builders, Inc., 1622 Douglas Ave., Kalamazoo, Mich., it was announced recently by W. C. Hammond, president.

Mr. Hathaway was educated at Technical High School, Fall River, Mass., and Tufts Engineering College, gaining his technical experience largely in the polishing and abrasive equipment field.

George H. Kenyon To Head American-Marietta Metal Finishes Department

According to an announcement made recently by the Industrial Finishing Division of the American-Marietta Company, 43 E. Ohio St., Chicago, Ill., Mr. George H. Kenyon has been appointed manager of the metal finishes department.

Kenyon came to the American-Marietta Company a year ago. He majored in engineering at Michigan State for two years then two years at McGill

George H. Kenyon

University where he graduated. After leaving school he was employed as a sales engineer by the Link Belt Com-

pany for a number of years before finding his way into the industrial finishes field in 1933. In that year he became associated with Devoe & Raynolds Company and later was transferred to the Jones Dabney division of that company.

A. B. Crane to Represent Solvents Recovery Service

The Solvents Recovery Service, Inc., Lister Ave. and Brown St., Newark, N. J., has announced the appointment of the A. B. C. Chemical Company, Waterbury, Conn., as its authorized agent throughout Connecticut, Rhode Island, and Southern Massachusetts.

Mr. A. B. Crane, head of the A. B. C. Chemical Company, believes that in making this connection with Solvents Recovery Service, Inc., he is offering a real service to the industry; for it has been proven that the reclaiming of solvents and thinners from sludge, waste, wash, spoiled lacquers, and so on, by the well-known Lofgren Process, offers a real saving to the users of such materials.

Mr. Crane has been associated with the metal finishing industry for a number of years, first in the paint field, and later becoming interested in solvent degreasing. He organized his own company in order to become New England distributor for the Mechanical Process Corp., South Orange, N. J., who has manufactured degreasing ma-

A. B. Crane

Now--It is *SUPER*-Cleaning!

- WITH OUR ADVANCED WASHING PROCESS
- USING RADICALLY NEW SYNTHETIC SOLVENTS
- CREATING A COMPLETELY BRIGHT SURFACE
- FREE OF INERTS, WATER SPOTS and RE-ACTIONS
- ON STEEL, ZINC, COPPER, BRASS, ETC.
- BEFORE PLATING, PAINTING, RUST-PROOFING
- WITHOUT TOXIC OR DESTRUCTIVE EFFECTS
- PROVED IN MID-WEST'S GREATEST PLANTS

Write for the Surprising Cost Facts

SOLVENTOL

SOLVENTOL CHEMICAL PRODUCTS, INC., 12001 E. JEFFERSON, DETROIT

chines for a number of years under the trade name of "D'Oilers." In the past year a number of these machines have been installed in Connecticut and Massachusetts.

Eugene Phillips Joins The Packer Machine Company

The Packer Machine Company, 452 Center St., Meriden, Conn., manufacturer of Packer-Matic Automatic Polishing and Buffing Machines, announces

Mr. Eugene Phillips

the addition to its staff of Eugene Phillips as a sales and service engineer.

Mr. Phillips has started his duties with The Packer Machine Company and is now available to assist his many friends in the trade in their polishing and buffing problems, a business in which he is very well qualified.

For the past few years Mr. Phillips was associated with The Puritan Company, Waterbury, Conn., manufacturer of buffing compounds, in the capacity of sales manager.

U. S. Stoneware Acquires Federal Clay Product Company

The United States Stoneware Co., Akron, Ohio, manufacturer of corrosion-proof chemical equipment, has acquired The Federal Clay Products Co., Mineral City, Ohio, along with its extensive clay and coal deposits.

The newly-acquired company has been incorporated as The Federal Refractories Corporation, to continue its old and well-known line of fire brick, refractories, high-temperature cements, and so on.

The Federal plant will be expanded to handle the rapidly increasing business of The United States Stoneware Company on tower packing rings, spiral rings, acid-proof brick, lining tile, and so on. The Tallmadge, Ohio, plant will thus be enabled to re-align its production facilities to care for its present record-breaking volume of business on acid-proof piping, tank linings, process equipment, jar mills, acid-proof tanks, pumps, and so on. New equipment is being installed with that purpose in view.

Industrial Chemical Products Co. Opens Cleveland Office

The Industrial Chemical Products Co., 3777 Bellevue Ave., Detroit, Mich., has announced the opening of its Cleveland office at 1900 Euclid Ave., Cleveland, Ohio.

Mr. Ralph S. Lamie is in charge of this office, and will have charge of the sale and distribution of Industro Metal Cleaning Compounds, Sol-Klean, Sodol, and Rustproof Oil products for Eastern Ohio, Western New York, and Western Pennsylvania.

Pittsburgh AES to Hold Annual Educational Session and Banquet

The Pittsburgh Branch of the American Electroplaters' Society will hold an Annual Educational Session and Banquet Saturday, March 15. Full details of the meeting may be obtained from Mr. S. E. Hedden, President, Pittsburgh Branch, 227 Fifth Street, Aspinwall, Pa.

Dr. Young to Manage Convention Team

According to an official announcement, Dr. C. B. F. Young has been selected by Mr. Joe Barron, AES Convention Chairman, to manage the East baseball team which will play against an All-West team headed by Co-Captains Frank Savage and Rudy Hazucha during the American Electroplaters' National Convention Week, June 9 to 12.

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BOSTON BRANCH DEFIES COMPETITION-!
AMERICAN ELECTRO PLATERS SOCIETY
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A REAL DISH IN STORE FOR YOU AND THE LADIES---DON'T FORGET TO BRING THEM-
REMEMBER ME! TIE A STRING AROUND YOUR FINGER AND DON'T FORGET TO MAKE RESERVATIONS EARLY!
ANDY GARRETT WATCH DOG OF BOSTON BRANCH
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SEE America's HISTORIC SHRINES
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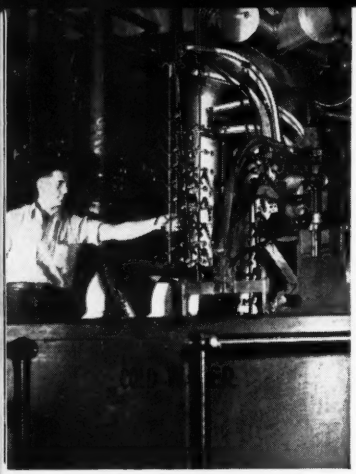


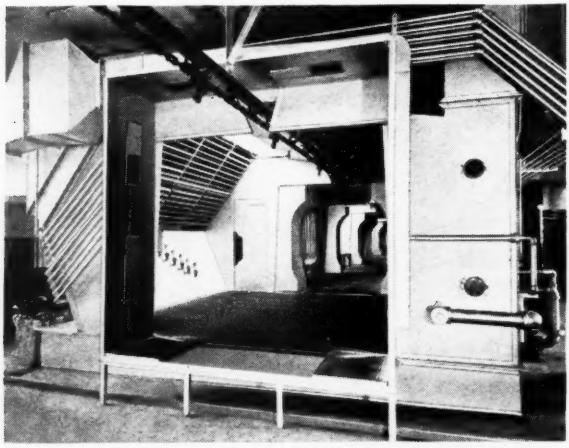
New PLANT EQUIPMENT AND Materials

Industrial Hydro-Whirl Spray Booth

An unusual principle in a spray booth construction is incorporated in the new Hydro-Whirl developed by Industrial Sheet Metal Works, 630 E. Forest Ave., Detroit, Michigan.

By virtue of a changed direction of air forces, the paint is trapped before it has had the opportunity to travel very far into the booth. Consequently, all the pigment is brought down almost immediately after its impact with the water, into the sludge tank below, where it can easily be skimmed off. All this is achieved through the proper balance between the speeds of air and water and the static pressures. The manufacturers claim that the necessity for cleaning the spray booth is thereby almost obviated and maintenance costs become negligible.

The unit may be used singly or as a part of a continuous setup of booths. In the latter fashion, the arrangement is staggered and so constructed as to allow no possibility of "over-spray." Washed, filtered, and temperature-controlled air is supplied to each unit in a perfect balance between supply and exhaust. According to the manufacturer, this system lends itself to operation at fullest efficiency whether production is down to a minimum or up to its maximum.

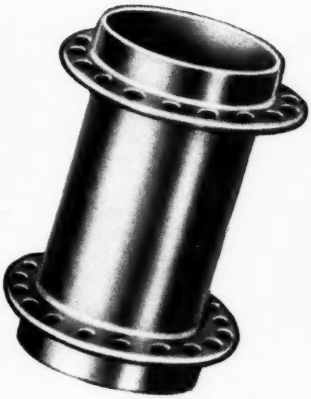


Industrial Hydro-Whirl Spray Booth

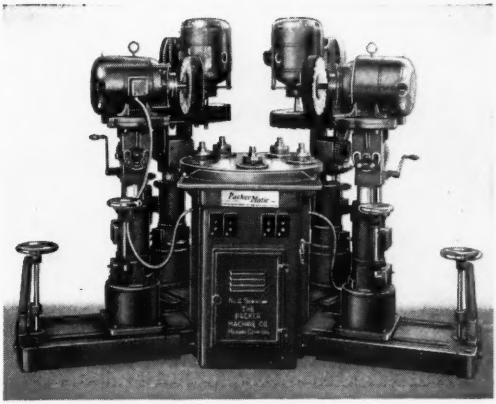
Paasche Shell Finishing Unit

The accompanying illustration shows an Automatic Airfinishing and Drying Unit for application of black paint to 20 mm. shells at a rate of 17,000 per 8-hour day, which has been placed on the market by Paasche Airbrush Co., 1910 Diversey Pkwy., Chicago, Ill. The unit includes special automatic aircoating

Multiple WHEELS *Multiple* FACES
on PACKER-MATIC



Polished on PACKER-MATIC Automatically



PACKER-MATIC No. 4 ROTARY TYPE complete with Automatic Composition Applicator, centralized control for economical operation.

Cylindrical shaped parts with projecting faces are routine work on PACKER-MATIC . . . The multiple wheels, each with a different grit, permit volume production at a definite saving of time and labor . . . Multiple Wheels cover Multiple Surfaces . . . Automatic Polishing and Buffing is essential to meet today's demand for efficient, speedy production . . . ROTARY — STRAIGHT LINE CONVEYOR — and ROLL Types — there is a PACKER-MATIC for your requirements.

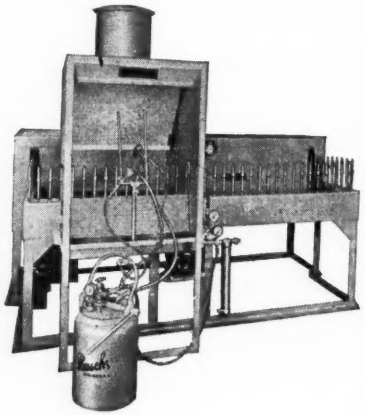
WRITE DEPT. TS for the PACKER-MATIC story and aid your Production Problem.

•AUTOMATIC POLISHING & BUFFING MACHINES

Packer-Matic

THE PACKER MACHINE CO., MERIDEN, CONN., U. S. A.

and drying unit approximately 8 ft. long by 3 ft. 9 in. wide, equipped with steel roller chain, supporting 164 revolving spindle assemblies, automatic off and on control for airbrushes, varying speed



Paasche Shell Finishing Unit

pulley and reducer to operate the chain at speeds of 4 to 9 lineal feet per minute, all mounted to structural steel frame, electrically welded.

The Paasche unit includes one electrically welded drying oven approximately 8 ft. long by 1 ft. 8 in. wide and 1 ft. 6 in. high, insulated with rock wool and equipped with electric strip heater, thermostatically controlled to provide the required range in temperature. The unit also includes automatic airbrushes, "clamptight cover" pressure feed material tank, water, oil and dirt separator to provide clean, dry air, including regulator and gauge, and exhaust unit with explosion-proof motor, spray booth and duct to fan.

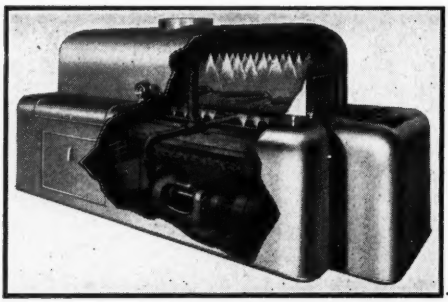
Excelchrome Aluminum Enamel

A series of three aluminum finishes for finishing steel, copper, brass, iron, and galvanized metal to be known as Excelchrome A, B, and C have been placed on the market by The Excelsior Varnish Works, Inc., 1228 W. 74th St., Cleveland, Ohio. These aluminum finishes are said to produce bright, brilliant, beautiful, smooth silvery finishes of unusual durability and elasticity. Excelchrome finishes are available in ready mixed form, and ready to use. Excelchrome "A" Aluminum Enamel is available in two types, one will air dry in 2 to 3 hours and the other will bake at 275 deg. F. in 30 minutes. Excelchrome "B" Aluminum Enamel will resist heat up to 1000 deg. F. and bakes at 300 to 350 deg. F. for 30 minutes. Excelchrome "C" Aluminum Enamel is specially adapted for quick air drying work and is said to set dust-free in 10 minutes and harden in 25 minutes.

According to the manufacturer, Excelchrome Aluminum finishes do not discolor, blister, or peal off. By means of infra-red baking, the Excelchrome finishes can be dried in from 7 to 10 minutes.

Murray M Series "Murco" Unit Heater

A unit heater having a modern streamlined cabinet and streamlined non-air-restricting motor supports together with die-formed fan shroud that is said to increase air quantity and decrease noise and horsepower, to be



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Industrial Washing Machines

Streamlined design. Hidden motors, pumps and pipes are easily assembled. Piping and nozzles located to insure thorough cleansing of all surfaces. Rugged and efficient pressure pump. Corrosion resistant spray nozzles — from mist to open stream. Monorail, Belt or Gravity type conveyors designed to carry any shape or size material. Variable speeds on conveyor drive synchronize production.

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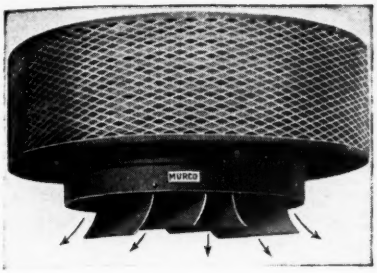


Murray M Series "Murco" Unit Heater

known as the M Series "Murco," has been announced by the D. J. Murray Mfg. Co, Wausau, Wis. The design of the individual all-copper turbo spiral fin tube core provides an even distribution of heated air at high velocity, and the individual tubes prevent stresses due to unequal expansion. The entire unit is spring suspended and floats free in the casing, there eliminating rigid connections between the cabinet and the unit.

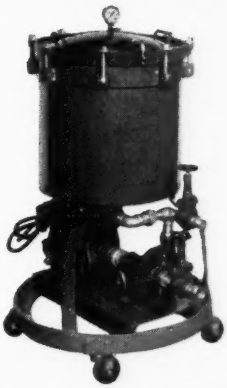
The Murray M Series Murco Unit Heater is made in 27 different models for steam capacities and eight models for hot water capacities. The unit has a baked crinkle enamel finish and is said to be ideal heating equipment for stores, offices, garages, factories, public buildings, and so on.

Fostoria 3267-FXM-102 Model Fluorescent Lamp

The illustration shows the Model 3267-FXM-102 Fluorescent Lamp which has been placed on the market by The Fostoria Pressed Steel Corporation, Fostoria, Ohio. This lamp is one of a variety of models in the fluorescent type,

Fostoria 3267-FXM-102 Model Fluorescent Lamp

SURE CURE
FOR SPECKS



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HORIZONTAL - PLATE
FILTER

Eliminate foul plating solutions once and for all. End speckled or imperfect finishes. The Sparkler Plating-solution Filter meets all your requirements and cuts filtering time, improves quality and reduces costs. It filters all solutions—bright nickel, copper cyanide, zinc, cadmium, chromium, silver—faster, more efficiently than any other unit on the market and minimizes tank fouling, thus requiring fewer tank cleanings. Other advantages include compactness; portability; intermittent service without disturbing clarity; savings in filter aids; and easy cleaning.

Available in ordinary steel, hard rubber, stainless steel and pure nickel construction.

Capacities up to 5,000 g. p. h.

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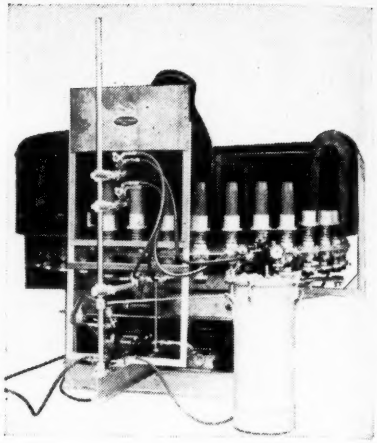
mounted on a wide variety of flexible arms, designed to meet the individual lighting problem in the machine shop.

An assortment of bases and clamps permits attachment of the fixture to machines, benches, or other equipment, making it possible to adjust the unit so that the worker will have light where he needs it most—whether for high intensity on a close operation or for general illumination over a machine or bench. All of the Fostoria lamps in the No. 600 Series are of the small, portable type, using one tube of either 15 or 20-watt size.

Eclipse Projectile Painting Unit

The painting of projectiles from 37 mm. up to 155 mm. can be handled automatically with a special machine developed by the Eclipse Air Brush Co., Inc., 400 Park Ave., Newark, N. J. The machine is shown in the illustration and consists of a 7 ft. indexed turntable with 36 rotating spindles which carry the shells in front of automatic spray guns that are synchronized with the turntable.

After the spraying operation, the projectiles are carried through a steam jacketed, tunnel type, drying oven mounted on the table opposite the spray guns. The shells are placed on the table and removed manually. The rate of operation is 500 pieces per hour when six-minute pyroxylin lacquer is used.



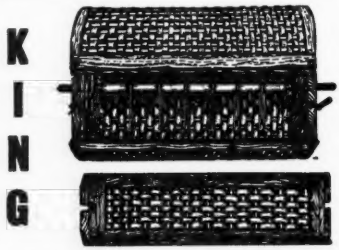
Eclipse Projectile Painting Unit

Torit Dust Collector

A portable, self contained dust collecting unit for polishing and grinding wheels has been placed on the market by Torit Manufacturing Co., 289 Walnut St., St. Paul, Minn. The Torit Dust Collector can be placed wherever convenient near the grinding or polishing wheel.

Dust-laden air is drawn from hoods

INVESTIGATE
FOR SOMETHING
BETTER
SIZES FOR ANY EQUIPMENT



PLATING BARRELS

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Use them once—you'll use them always

JOHN KING
48 SPRINGFIELD ST., DAYTON, OHIO

BLACK *for Iron and Steel*

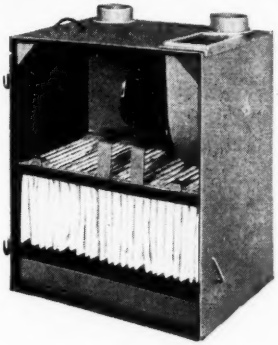
Original, low temperature, patented method

One salt; one bath; one control; one operator. Protects and beautifies; lowers finishing costs; speeds production.

Ask for details. Sample JETALized free.

ALROSE CHEMICAL CO.
PROVIDENCE, R. I.

surrounding the wheels down through a compartment behind a dust-proof motor in the cabinets, then up through a series of chemically-treated, spark resistant cloth filter bags. Heavy particles of dust fall into a tray beneath the bags, while lighter particles adhere to the outside of the filter bags. The filtered air is re-circulated into the room—or it may be piped outside of the plant or department if desired.



Torit Dust Collector

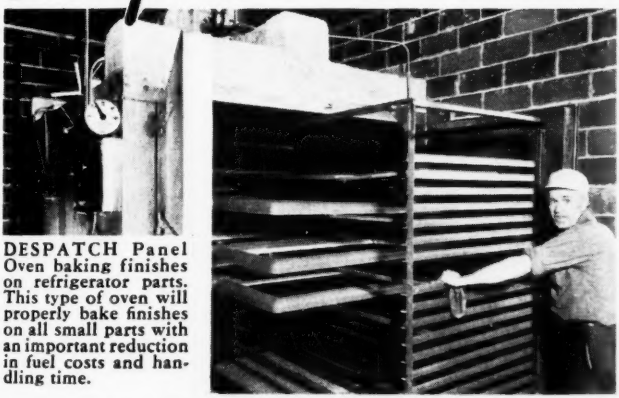
The Torit Dust Collector is designed for easy installation on polishing or grinding wheels out of reach of a central exhaust system. The unit is available in a number of sizes, which range in capacities of from 150 to 650 c.f.m.

Koven Still and Condenser

The still and condenser unit shown in the illustration herewith is now being manufactured and marketed by L. O. Koven & Brother, Inc., 154 Ogden Ave., Jersey City, N. J. This unit is designed to remove the high volatile solvents which must be condensed and recovered from lacquered workpieces as the pieces are being dried. The particular design shown was adapted to provide processing in a closed system to avoid the loss of volatile material.

The Koven Still is constructed in the form of a flat rectangular welded steel tank which accommodates six smaller

Improved DESPATCH



DESPATCH Panel Oven baking finishes on refrigerator parts. This type of oven will properly bake finishes on all small parts with an important reduction in fuel costs and handling time.

Finish Baking and Drying OVEN

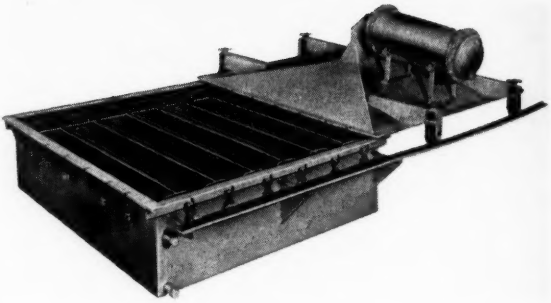
New features to assure better finish baking results with direct or indirect fired heaters—also to assure lower fuel bills and speedier material handling.

Write Today for Bulletin No. 51

DESPATCH OVEN COMPANY

MINNEAPOLIS • MINNESOTA

Koven Still and Condenser



welded steel tanks or trays into which the workpieces are placed. The trays are 6 in. by 48 in. and are said to be easily lowered into and out of the main tank. Each tray is heated by means of an oil bath. The oil bath is heated by means of steam coils which are the full length on both sides of each tray.

When the drier is loaded, the domed cover is slid on tracks over the top of the tank and sealed by tightening the quick closing swing bolts. The location of the condenser above the cover is said to keep it close to the source of vapor generation, thus making the unit as compact as possible.

The design of this unit is said to suggest a drying and solvent recovery process application on objects which are surface coated, as well as chemicals and other materials containing a high percentage of solvents. The process is said to assure full recovery of the solvents and uniform drying of the work.

Circle Fluid Purifier

A fluid purifying unit designed to filter and clarify chlorinated and other dry fluids has been placed on the market by Circle Machinery Corporation, 460 West 34th St., New York City. The units measures 27 in. wide, 50 in. high, and 34 in. deep.

The Circle Fluid Purifier has a built-in tank of 25 gal. capacity, into which the fluid can be poured. The fluid to be clarified is carried into a charging compartment by means of a pressure pump which is embodied in the unit. In the charging compartment, the fluid comes in contact with a blending compound known as "Circlene." The fluid is mixed with the compound in the charging compartment and is then carried to two clarofilters which consist of two copper cylinders lined with copper screens, and have filter bags in them.

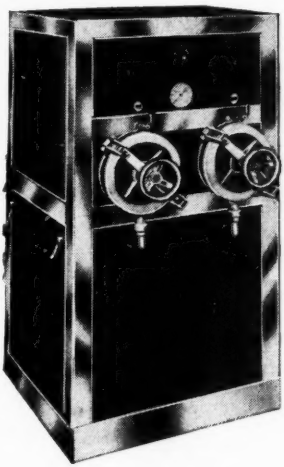
A continuous circulation in the filter

YOU'LL GET
BETTER CLEANING
BETTER PLATING
with
ORVUS
(A SULFATED FATTY ALCOHOL)
in your alkaline cleaning bath!
ASK FOR FURTHER DETAILS
PROCTER & GAMBLE · CINCINNATI, O.

Want to Improve Your Paint Job?

At no extra cost you can give your customers a better, longer-lived paint job. RUSTICIDE "50" not only cleans but also mildly etches and effectively rust proofs the surface. This inexpensive, non-toxic liquid is easy to handle, removes grease and rust, leaving an ideally toothed surface ready for immediate painting. Write us discussing your operation and we will send complete data. Rusticide Products Co., 3125 Perkins Ave., Cleveland, O. Est. 1920.

bags with the Circlene compound is said to mechanically trap all solid impurities and to absorb dissolved impurities so that a crystal-clear fluid is delivered from the clarofilters to a built-in re-



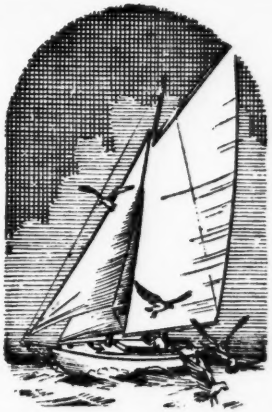
Circle Fluid Purifier

serve tank. According to the manufacturer, 25 gallons of fluid can easily be purified in 10 minutes. The pure fluid can be emptied from the reserve tank into any barrel or storage container.

The Circle Fluid Purifier is equipped with time clock so that the operation can be set to any desired time. The unit is also equipped with a pressure gauge which indicates the quantity of impurities trapped in the clarofilter bags. Circle Fluid Purifiers are also available for the purification of 50 and 75 gallons of fluid every 10 minutes.

Metalbond

A process for rust-proofing metal to be known as Metalbond is now being marketed by International Rustproof Corporation, 12507 Plover Ave., Cleveland, Ohio. The fundamental purpose of the process is to provide a passive, resistant iron phosphate surface over which finishing materials can be applied. The process includes an inhibitor wash known as Corrosol which may be used alone or it may be followed by a Metalbond dip to provide a heavier iron



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DRAWCO GRINDING PASTE

- Uniform Product
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Write for Price List and Literature

Industrial Lubricants Co., Inc.
5736 TWELFTH ST. DETROIT, MICHIGAN

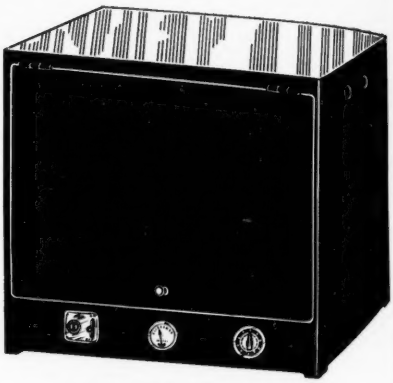
phosphate base.

Metalbond provides a dense iron phosphate base and is designed for use following cleaning and degreasing operations.

Engine Cylinder Baking Oven

Aeronautical Trading Co., Floyd Bennett Airport, Brooklyn, N. Y., has recently placed on the market a cylinder baking oven designed for quick baking of enamel on aircraft cylinders. Featuring high heat obtained by low wattage, this unit can be plugged into any electric line having 110 volt current. This unit is heated by an element which is mounted inside directly in the bottom center. A temperature of 450 deg. to 500 deg. F. is obtainable.

The outside dimensions of the baking oven are 26 in. by 20 in. by 18 in. and the inside dimensions are 18 in. by 17 in. by 24 in. The unit is designed to provide ample space for baking three aircraft cylinders simultaneously.



Engine Cylinder Baking Oven

The Aeronautical Baking Oven is insulated throughout with Rockwell asbestos and also metal covering on the inside and outside. A temperature gauge with a range of from 0 to 500 deg. F. is mounted on the front panel of the unit.

Westinghouse 2-FP-100 Industrial Luminaire

An open-end twin lamp luminaire utilizing 100-watt, 60-in., white or daylight fluorescent lamps and designed especially for general high level illumination in industrial plants is announced by the Westinghouse Electric & Mfg. Co., Lighting Div., Edgewater Park, Cleveland, Ohio. The luminaire, which is designated as the 2-FP-100, meets RLM specifications, is applicable to installations requiring high mounting heights, and is available for operation on 110-125, 199-216, and 220-250 volts, 60 cycle alternating current.

The complete Westinghouse 2-FP-100

YOUR BEST DEFENSE

Against

Paint Failure and Rust

METALPREP

"Used First — Makes Your Paint Finish Last"

The complete metal cleaner and rust remover for use on all sheet metal surfaces before painting. Gives a tooth to the metal for better paint adhesion.

Write for Questionnaire 1-16 in order to receive a sample suitable for your needs.

NEILSON CHEMICAL CO.

6564 BENSON ST. DETROIT, MICH.

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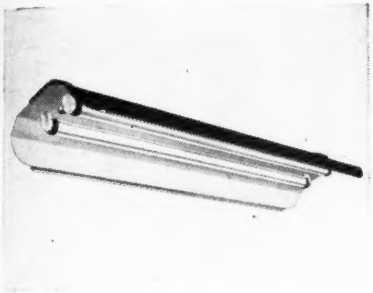
ROBERTS Says: DIGGING THAT GETS RESULTS. Send us your hard jobs. If it's a rush order, a little extra service or something out of the ordinary you need, we'll go all the way to give you satisfaction.

THE ROBERTS ROUGE CO., Stratford, Conn. Tel. 7-2878

Specialists in Manufacturing Thoroughly Dependable Gold, Sterling and Silver Plate Rouges; Stainless Steel, Chrome and Crocus Compounds.

unit includes a hood, reflector, lamp holders, starting device, and ballast equipment. The fabricated sheet steel hood with all auxiliary equipment mounted and wired as part of the entire assembly provides easy access for line connections during installation. Two reflector types provide a choice between totally direct and diffused, or semi-direct, illumination. The direct type reflector throws all light downward, whereas the diffuser unit permits a minimum of approximately 2½ per cent upward light to pass through apertures above each lamp, thereby reducing brightness contrast between the ceiling and the lighted area. Both type reflectors are 18 gauge porcelain enameled steel and provide a shielding angle of 14 deg. below the horizontal when viewed normal to the lamps. A two-lamp ballast provides a power factor of over 90 per cent, minimizes cyclic flicker, and assures satisfactory lamp performance.



Westinghouse 2-FP-100 Industrial Luminaire

The Westinghouse 2-FP-100 Industrial Luminaire is arranged for rigid, flexible conduit or chain suspension mounting, is supplied completely wired, and has a smooth silver-gray baked enamel finish.

Goodrich Outlet and Overflow Valve for Pickling Tanks

An improvement in the method of handling acids used in steel pickling operations has been announced by The B. F. Goodrich Company, 450 S. Main St., Akron, Ohio, as a result of a development of a new combination outlet and overflow valve for these tanks. The new product is a modification of the

Did you know that . . . .

Approximately 27 gallons of finishing material is required to completely finish the average coal car? See Page 11.

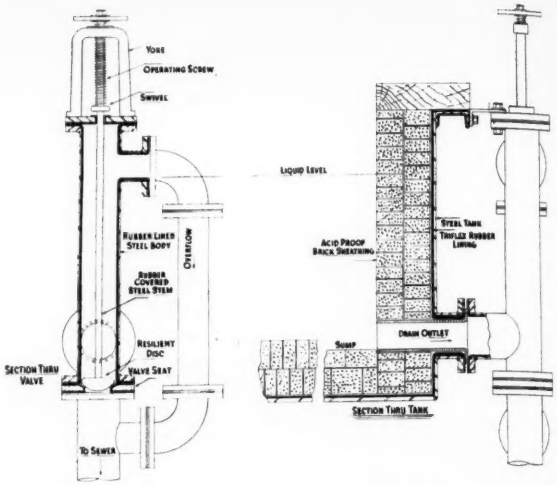
Certain gold alloys can be age hardened to provide coatings that are literally stronger than steel? See Page 26.

Simple nomographs can be used to determine the time required to obtain a specified thickness of plate, the cost of material used in a plating operation, and so on? See Page 42.

By means of precision barrel operations, it is possible to produce balls wherein the diameter accuracy may be held to within one two hundred thousandths of an inch? See Page 61.

Special engineering training courses for national defense work are now available to finishing department executives? See Page 69.

(*Left*)—Goodrich Outlet and Overflow Valve for Pickling Tanks
(*Right*)—Installation View



patented rubber - lined Vulcalock valve developed by Goodrich for handling corrosive and abrasive fluids.

Installed entirely on the outside of the tank, the outlet and overflow installation uses a wheel and screw attached to the valve stem to raise and lower the valve disc. It can be fitted to existing pickling tanks, or built into the construction of new ones. Provision is made for automatic overflow at a predetermined level, thus maintaining constant liquid level in the tank.

Among the principal advantages of the new method, according to the manufacturer, is the ease and rapidity with which the valve can be operated and the solutions completely drained from the tank, any accumulated sludge being carried away rapidly and completely, with a minimum of flushing.

Previous methods used have been siphoning, or discharge through a removable drain plug installed in the tank's bottom. With a siphon, much labor with hose and shovel was required to remove the sludge. In the second system the drain plug often proved an obstruction which was caught and jarred loose by the steel being handled in the pickling vat, with resultant loss of acid.

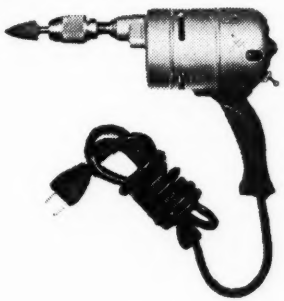
The new valve, completely rubber lined, is fitted with a low-cost replaceable, resilient, rounded disc which snaps over a circular plate at the lower end of the stem and provides an absolute seal when brought into contact with the rubber-covered seat ring. The valve is covered by U. S. Patent No. 1,947,257.

"Whiz" All-Purpose Electric Tool

Illustrated herewith is the "Whiz" All-Purpose Electric Tool which is now being marketed by Paramount Products Co., 48 W. 48th St., New York, N. Y. The tool is available in standard and two-speed models and can be used on steel, glass, wood, metal, Bakelite, plastics, bronze, cast iron, and various

other materials.

The Standard Model Whiz utilizes no less than 50 different accessories for use in drilling, grinding, sharpening, wire-

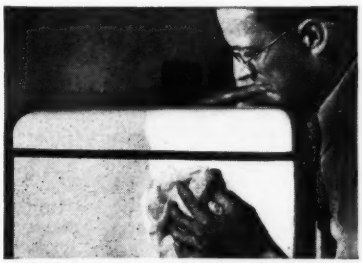


"Whiz" All-Purpose Electric Tool

brushing, sanding, polishing, sawing, shaping, etching, engraving, carving, and so on. The frame of the tool is made of die cast alloy for ease of handling and long life, and the handle is of the pistol-grip type. The three-jaw, coil spring chuck has a ¼-in. capacity and is triple-geared for extra power. Ball bearing thrust ensures smoothness of operation.

The Whiz operates on any 110-volt, alternating or direct current, being powered by a heavy duty Universal motor which is constructed so as not to overheat even when operated over long periods of time. A large cooling fan provides ample ventilation. The motor switch is arranged for operation with the same hand which holds the tool, and is of the permanent built-in "on and off" type. Large commutator brushes make for long wear, and screw caps are provided for easy replacement of brushes.

The Two-Speed Model Whiz combines normal speed and high speed in one unit and uses 200 different accessories, all of which are instantly interchangeable. The high speed provided by this model is especially suited for precision work such as carving, sawing, shaping, etching, and engraving. By means of the tool, the hardest steel or the softest cork can be handled with equal ease.



"MAGIC" TACK RAGS
IMPROVE YOUR FINISH 100%

MAGIC TACK RAGS remove specks, lint and sand particles--- bring out that deep, smooth luster, produce a faultless surface for white or colored finish. Why use "home made" tack rags when you can buy MAGIC TACK RAGS at trifling cost! They are tackier, do not dry--- are dust-proof and spontaneous combustion proof. Packed in dozen and gross lots or more. Made only by the

Wm. A. Juergens Co.
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If your dealer does not carry Magic Tack Rags, write us for sample.

Send Sample for Free Production Estimate.

Step Up Production!

WITH "ACME"
Straight Line, Rotary or Semi-Automatic Polishing and Buffing Machines.

STEP DOWN Polishing and Buffing COSTS!

ACME MANUFACTURING CO. . . 1642 Howard St., Detroit, Mich.

The Whiz All-Purpose Electric Tool is 7⅝ x 6 in. in size, weighs approximately 3½ lb., and is supplied complete with chuck, rubber cord and plug, ready for use.

Rome Automatic Electric Glue Heater

A compact glue heater, fabricated with a heavy steel cabinet at the top of which is assembled an insulated, nonferrous metal water reservoir in which the glue pails are suspended is now being marketed by Rome Machinery Sales & Engineering Co., 627 Webster St., Rome, N. Y. A suitable frame, above the reservoir, supports each glue pail in its respective position.

A thermocouple which is inserted into the reservoir actuates an automatic temperature control unit in conjunction with an immersion heater assembled in the reservoir. The thermocouple maintains a temperature range of ± 2 deg. F. of instrument setting. An overflow connection is provided in the heating reservoir, together with a hot water drain bibb.

The Model E6-2 Rome Automatic Electric Glue Heater shown in the illustration is equipped with six, two quart glue receptacles. These units are available in four, five, six, and eight pail sizes with glue pails of two, three, or four quart capacity in any combination.

The Rome Glue Heater is thermostatically controlled through a temperature range of 50 to 350 deg. F. It is suitable for operating on alternating or direct current.

Rome Automatic Electric Glue Heater

The heater cabinet is provided with a hinged door, opening into a convenient compartment which can be used for the storage of glue and water measuring dippers, glue soaking prior to heating, and so on. The automatic electric control instrument is mounted on a panel in conjunction with a line disconnect switch suitable for wall mounting within five feet of the heater or directly to the side of the heater cabinet.

The Model E6-2 is 30½ in. long, 20 in. wide, and 36 in. high. The capacity of the immersion heater is 4,000 watts for this unit.

Safety "Non-Slip" Flooring

Greater safety for workers while working on cat walks, tank tops, bridges and other similar structures is

provided by means of a Safety "Non-Slip" Flooring now being marketed by the Industrial Sheet Metal Works, 630 E. Forest Ave., Detroit, Mich. The

Safety "Non-Slip" Flooring

flooring is said to find further use in places where workers are confined, such as in spray booths. Its open design not only ensures better ventilation of air within the interior where the man works, but also enhances his foot comfort while standing or walking.

The bridge-type construction of the Safety Non-Slip Flooring is designed to withstand an unusually heavy load and enables the flooring to be adapted to installation of all types.

Leiman Self-Contained Dust Collector

Dust can be drawn from the top and from the bottom of a grinding wheel or buff simultaneously by the use of the motor-driven self-contained dust collectors now being offered by Leiman Bros., Inc., 101-W-2 Christie St.,, Newark, N. J. The collector prevents the escape of dust no matter in what direction the workpiece may be manipulated.

The branched piping may be varied to lead each branch to a separate dust hood over a separate wheel or buff, thus collecting dust from two wheels at the same time. The unit is completely self-contained, making it possible to move it from one location to another at any time. The unit can be supplied for use with one or two wheels up to

NOW...

S-310

RUST INHIBITIVE

Formulated specifically for the following properties:

1. **Very fast air-drying**
2. **Water-whiteness**
3. **Tenacious adhesion**
4. **Hardness combined with flexibility**

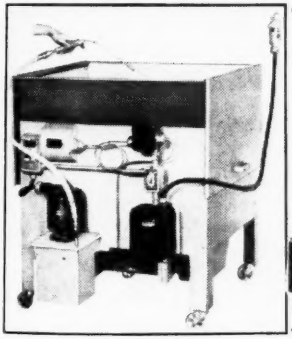
and

RUST RESISTANCE

S-310

is used and recommended as a clear coating for hand tools, machine tools, hardware and wherever a clear protective coat for bright metal is required.

The Varnish Products Co.
5208 Harvard Ave. Cleveland, Ohio



Cut Cleaning Costs and Speed Up Production with PHILL-CO *Portable* Degreasers

Eliminate unnecessary, obsolete, costly handling operations that bottleneck your parts at the cleaning stage! *"Take degreasers to the work, instead of work to the degreasers."* Phill-co Portables are self-contained, electrically heated and controlled—need NO INSTALLATION, no steam, water, plumbing, no gas lines. Total operating cost, including solvent and electricity, only 60¢ to 90¢ per ton, based on actual figures reported by users.

Write us. Let us apply free engineering, laboratory and planning service to your cleaning problems.

MODEL 36-3
220 V.-60 Cy.-3 Phase
Vapor Chamber
36"x30"x22"

Phillips Manufacturing Co.
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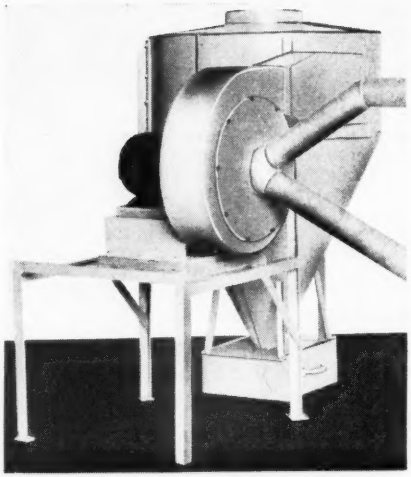
Distributors in principal Cities



Leiman Self-Contained Dust Collector

24 in. in diameter and of average width or for the collection of dust from any other kind of dust-creating operation. The unit is intended for use in any line of manufacture on materials of metal or other materials.

Koroplate

A new grade of Koroseal paint, to be known as "Koroplate," designed to protect metal surfaces against chemical reactions and recommended for service wherever extremely corrosive conditions are present is announced by The B. F. Goodrich Co., Akron, Ohio. Base of the paint is Koroseal, a synthetic material created from polyvinyl chloride, which is derived by a series of chemical reactions from coke, limestone, and salt.

Koroplate is a liquid at room temperatures and requires no heating before application. At ordinary temperatures it can be either brushed or sprayed and can be thinned with either brush or spray thinners when necessary. The paint is made in semi-glossy black only and must be used in conjunction with a Koroseal primer having similar characteristics.

When thoroughly dry, Koroplate is said to be extremely resistant to the action of fumes and vapors from acids, alkalies, and salts at room temperatures or slightly above. According to the manufacturer, it resists all acids except concentrated formic and acetic acid and is not affected by brass, chrome, nickel, cadmium, zinc, copper, silver, or tin plating solutions. Such solutions are not contaminated by the thoroughly dried paint, although the material is not recommended for constant immersion in liquids.

Among the uses to which Koroplate has been successfully put are application on sour crude storage lines and underground pipe and gathering lines, and for the painting of fume ducts in plating rooms.

Here it is!

NYLENE
WHITE SYNTHETIC ENAMEL

Mar proof and alkali proof. Bakes from 150 F. to 450 F. in 10 to 30 minutes.
High reflection test. **Forever white**

Samples on request

C. L. ROWE CORP.
152 BANKER ST. **BROOKLYN, NEW YORK**

Fostoria "Para-Sphere" Reflector

A hexagonal shaped reflector for infra-red baking to be known as the "Para-Sphere" has been placed on the market by The Fostoria Pressed Steel Corporation, Fostoria, Ohio. By means of the application of the "Para-Sphere" reflector, the loss of heat in infra-red baking tunnels is said to be reduced to a minimum.

The reflector, which is known as Model "QR," is hexagonal in shape, thus making it possible to obtain an enclosed

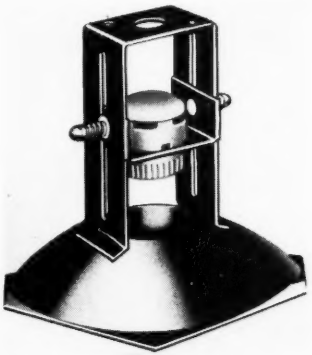
For a real good polishing job use

KEYSTONE EMERY

TURKISH — NAXOS — AMERICAN

KEYSTONE EMERY MILLS *Write for Sample* **4316 Paul St., Phila, Pa.**

type of near infra-red tunnel. Inasmuch as it is possible to "nest" hexagonal shapes closely, an almost solid reflecting surface is obtained in multiple assembly installation.



Fostoria "Para-Sphere" Reflector

The Para-Sphere hexagonal reflector measures 10¼ in. in diameter. It is available in single units or in multiple assemblies.

A smaller size Model "QM" measures 7⅝ in. in diameter and is similar in appearance.

Mobile Fire-Fighting Unit

A compact and versatile fire-fighting unit for industrial use has been perfected by Walter Kidde & Company, Inc., Bloomfield, New Jersey, manufacturers of carbon dioxide fire extinguishing equipment. The unit is designed to be hooked up as a trailer for emergency use.

This mobile unit carries heavy armament against fire. The big artillery is a battery of six 50-pound carbon dioxide cylinders equipped with a hosereel and nozzle. The cylinders are manifolded together and are individually operated by valves on each cylinder, permitting employment of all or any part of the unit's capacity on a large or a small fire.

Carbon dioxide gas is discharged onto the fire through 100 feet of ½-inch hose, fed through a trunnion type manifold. Allowance is made for control of the

"DOUBLE HEADING"

with 1F Turkish Emery and 1F Naxos Emery

These HAMILTON products are used by W. R. Case & Sons Cutlery Company of Bradford, Pa., to glaze both sides of knives at the same time. TRY: "Indian Brand" Turkish and Naxos Emery or "Hecco Brand" American Emery. Write for your trial lot—today.

(Photo Courtesy W. R. Case & Sons Cutlery Co.)

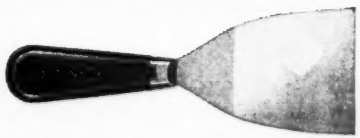
HAMILTON Emery & Corundum Co.

CHESTER, • MASS.

Supreme Speed and Workmanship

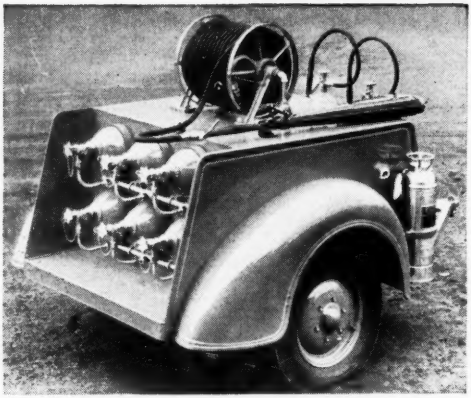
SUPER-FLEX FINISHING KNIFE

RIDGELY



Extra spring-steel flexibility allows conformity to shape of product being finished. Saves labor, time, expense; improves workmanship. Highly tempered and ground English steel blade, 2, 3, and 4" widths. Special sizes and thicknesses to order. Ridgelite composition handle fits the hand, cannot loosen. Write for low quantity prices. Sample $1.00. Made only by

THE RIDGELY TRIMMER CO. DEPARTMENT PF SPRINGFIELD, OHIO



Walter Kidde Mobile Fire-Fighting Unit

discharge at the "business end" of the extinguisher, through use of a shut-off valve on the nozzle handle. This permits discharge to be interrupted while operator is maneuvering for position against a blaze.

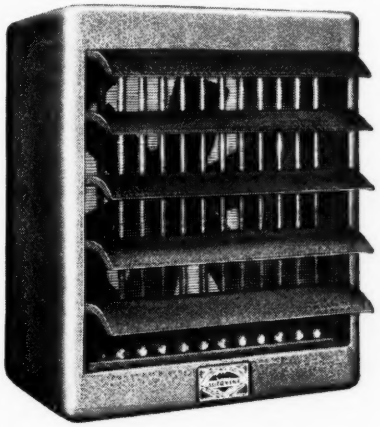
For smaller fires, two portable carbon dioxide extinguishers of 15 pounds capacity are carried on the front platform of the trailer, together with two 2½ gallon pure-water extinguishers which operate on the syphon principle. They contain a small cartridge of carbon dioxide which is released when the extinguisher is inverted, and which propels a water stream to an effective distance of 30 to 40 feet.

Primarily, this trailer unit is designed for use on large fires, inflammable liquids and electrical equipment. Carbon dioxide is especially effective against these two types of fire. In addition to being one of the fastest known extinguishing agents it is safe to use on live electrical equipment, since it is a non-conductor. Moreover it is clean, dry, leaving no residue, doing no damage.

Autovent Steam Unit Heater

A completely redesigned line of steam unit heaters has recently been an-

nounced by Autovent Fan & Blower Co., 1805 N. Kostner Ave., Chicago, Ill. Many new features have been incorporated in the design of these units and



Autovent Steam Unit Heater

probably the one of greatest importance is the ruggedness of construction.

The casing is entirely new throughout. Streamlining, while not extreme, is distinctly modern and the two-tone Monel gray wrinkle finish adds a refinement that permits use in almost any type of installation. According to the manufacturer, strength and durability have been stressed in the casing design to give added protection to the heating element.

Each item of the assembly is dieformed, ensuring accuracy and stability. The vanes or deflectors have been recessed for appearance and are individually adjustable in order to direct heat accurately to working areas, to eliminate cold spots, and guard against over-heated zones.

These units employ the "31 Series" Autovent non-overloading fan wheels. A special screw compression fitting is used between tube and header, thus eliminating any welded or brazed joints. The coils are tested at 500 lbs. hydrostatic pressure and are said to provide efficient heating at any steam pressure from 2 to 150 lbs. gauge.

In addition to creating proper working temperatures, these unit heaters can be installed to stop drafts, eliminate excessive moisture, to hold back cold air seepage on unprotected walls, and to lessen heat loss even when outside doors are frequently opened. They are designed for installation in all types of commercial and industrial buildings.

Despatch Finish Baking and Drying Ovens

A very complete 12-page catalog covering Despatch Finish Baking and Drying Ovens for synthetic enamels, lacquers, varnishes, paints, enamels, and japans is now being issued by Despatch Oven Company, 622 S. E. Ninth St., Minneapolis, Minnesota.

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WANTED—By large Eastern Paint manufacturer, Products Finishes Service man. Must have good personality and extensive practical experience as finisher in industrial plants. Should be familiar with modern finishes and all methods of application such as spraying, dipping and roller coating. Give age, experience and salary expected in letter of application. Write PRODUCTS FINISHING, Box 35, 431 Main Street, Cincinnati, Ohio.

• This Opportunity Section is available for classified advertisements featuring equipment, employment, business opportunities, etc., in the industries devoted to the cleaning, plating, polishing and finishing of metals. For advertising rates and other information address:

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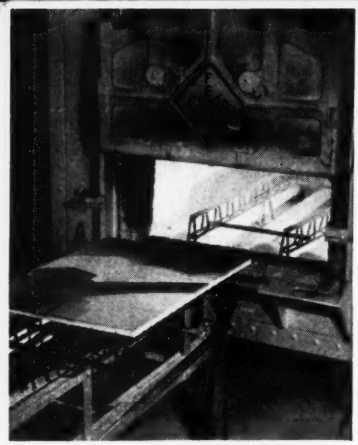

FOR YOUR Catalog LIBRARY

To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. Synthetic Resin Cements
An 8-page catalog describing Asplit Cement Powder and Asplit Cement Solution for the preparation of mortar to be used in laying acid-proof brick is now being issued by Pennsylvania Salt Manufacturing Company, 1000 Widener Bldg., Philadelphia, Pennsylvania.

2. Torit Dust Collectors
Self-contained units for carrying away dust-laden air around grinding, cutting, and polishing wheels are illustrated and described in a bulletin now being issued by Torit Manufacturing Co., Walnut and Exchange Sts., St. Paul, Minnesota.

3. Hy-Speed Filter Equipment for Plating Solutions
An 8-page catalog now being issued by Alsop Engineering Corporation, 1937 Norton St., Milldale, Conn., describes an entirely new approach to the problem of keeping plating solutions clean.

4. Milburn Gas and Air Regulators
A special portfolio describing Milburn single, two-stage, and ball seat type gas and air regulators is now being issued by The Alexander Milburn Company, 1436 W. Baltimore St., Baltimore, Md.

5. Electroplating Chemicals, Processes, and Materials
A 16-page catalog devoted to chemicals, processes, and materials for modern metal finishing is now being issued by the Electroplating Division of E. I. du Pont de Nemours & Company, Wilmington, Delaware.

6. The Waco Catalyst
Volume 5 of the Waco Catalyst in which the laboratory supplies and chemicals marketed by Wilkens-Anderson Co., 111 N. Canal St., Chicago, Ill., are illustrated and described is now off the press.

7. Speed Up
Speeding up production through the use of pre-finished metals in the sheet and coil form is the title of a folder now being issued by American Nickeloid Company, 1320 Second St., Peru, Illinois.

8. Mixing Equipment
A 24-page catalog describing and illustrating mixing equipment for industrial applications is now being issued by Eastern Engineering Company, 45 Fox St., New Haven, Connecticut.

9. Metal Cleaning Tips
The chemical classification and selection of alkaline metal cleaners is contained in a bulletin which has been prepared and is now being distributed by the Cowles Detergent Company, 10525 Carnegie Ave., Cleveland, Ohio.

10. Industrial Ovens
An illustrated industrial oven book featuring safety, speed, economy, and efficiency in industrial drying and finishing processes is now being issued by The Kirk & Blum Mfg. Co., 2816 Spring Grove Ave., Cincinnati, Ohio.

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11. Grinding Wheel Data Book
A 112-page catalog containing complete descriptive information about the manufacture, use and application of grinding wheels is now being issued by Abrasive Company, Tacony and Fraley Sts., Philadelphia, Pennsylvania.

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12. Dust Control
A complete story of dust control in words and pictures by means of Roto-Clone dust control equipment is now being issued by American Air Filter Company, Inc., 702 Central Ave., Louisville, Kentucky.

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13. Globe Finishing and Tumbling Barrels
One of the most completely illustrated catalogs on finishing and tumbling barrels for metal parts is now being issued by The Globe Machine & Stamping Company, 1250 W. 76th St., Cleveland, Ohio.

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14. Orvus for Alkaline Cleaning Baths
All those engaged in metal cleaning operations will be interested in information regarding an alkaline cleaning bath addition agent known as Orvus now being distributed by Procter & Gamble Co., Gwynne Bldg., Cincinnati, Ohio.

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15 Finishing Equipment Catalog
A very complete catalog illustrating and describing finishing equipment of all kinds is now being issued by Industrial Sheet Metal Works, 630 E. Forest Ave., Detroit, Michigan.

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16. Cleaning of Metals Before Electroplating
A 32-page booklet outlining formulas and methods for cleaning many different metals and alloys before electroplating is now being issued by Oakite Products, Inc., 20 Thames St., New York City.

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17. General Electric Reactrol System
Eight ways in which the Reactrol system gives exact temperature control are described in a bulletin now being issued by the General Electric Company, Schenectady, New York.

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18. Airway Ventilated Buffs
Cool cutting buffs for high speed buffing operations are illustrated and described in a 4-page folder now being distributed by Jackson Buff Corporation, 21-03 41st Ave., Long Island City, New York.

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